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ABSTRACT

Focusing on the training of agricultural specialists (supervisors and operational technicians) in Sudan, this study identifies issues in the general agricultural situation and the type of agricultural development practiced there, the education system's output of technicians, and the degree of harmony between education and national needs. The potential for Sudan's agriculture is discussed and background data provided on the systems of agricultural production now being used, including farming by irrigation, by the mechanized rain-fed method, and by traditional methods. An assessment of Sudanese development plans and prospects emphasizes the types of training needed and forecasts the number of specialists that the educational system must be prepared to produce in order to meet future national requirements. A description of the approach to agricultural training within the Sudanese educational system shows how students are channeled into technical fields and details agricultural instruction at the senior secondary level, at agricultural institutes, and at Sudanese universities. Having established background on agricultural potentials and on educational frameworks, the research team compares the supply of agricultural technicians with projected needs. They find inadequacies in national planning that result in deficiencies in the numbers of specialists, particularly in technicians in the field, in effective placement procedures for graduates, and in the inefficient use of trained personnel. (JW)

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RELATIONS BETWEEN EDUCATION AND TECHNICAL PROGRESS IN AGRICULTURE: TRAINING OF SPECIALISTS: THE SUDANESE EXPERIENCE

by Michel Gutelman
in collaboration with the National Sudanese Team:

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IN AGRICULTURE: TRAINING OF
SPECIALISTS: THE SUDANESE
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INTRODUCTION

The broad, underlying objective of this study is to highlight some of the relationships which exist between agricultural training and technological progress in agriculture. Although one is aware of the importance of these relationships, their precise nature is unknown. However, it is obvious that they play an important rôle in any rational attempt at planning agricultural development.

Basically, there are three ways in which education can assist agricultural progress. The first of these is by training the technicians, supervisors and skilled workers involved in agriculture, although they may not necessarily be farmers themselves. This is thus primarily a question of training the supervisors and operational technicians for a modern agriculture. The other way in which education assists, or can assist, is by training the farmers themselves. These two types of training are obviously linked but they are nevertheless to a certain extent independent and this enables us to treat them separately. The third way, which is much less direct and more difficult to assess, is the inculcation via the spread of basic education of a progressive and scientific attitude in the population as a whole and the farming community in particular. In this study, we shall be dealing only with the first of these three ways.

In view of the major technological, economic and social policy decisions which have been made concerning Sudan's agricultural development, it seemed logical to focus our analysis on the relationships between this development and the training of agricultural supervisors and operational technicians, since it is they who have the most direct influence as vectors of technological change. One needs only to describe the type of agricultural development adopted in Sudan to justify the decision to concentrate attention on this aspect, which does not however preclude us from examining some of the problems concerning the training of farmers.

Although limited in scope, a study of this kind cannot be done without first of all relating education to the overall problem of agricultural development and the problem of "socio-economic rural development". There are in fact many different ways of planning agricultural development, which may even be contradictory and which, as a result, produce - or at least should lead to - quite distinct types of training for rural development. For example, the choice might be between highly capital-intensive

development. In one case, the emphasis will be on the economic and productivity aspect of agriculture, whereas in the other, the emphasis will be on the social development of the rural population. The aim of an agricultural development project requiring capital investment might be either to increase productivity per man - particularly if labour is scarce - or, on the other hand, to increase productivity per unit of land - when land is the scarce factor. In the first case, the accent will be on mechanisation or even "hyper-mechanisation", in the second, the emphasis will be on using chemical agents, e.g., fertilizers, insecticides, herbicides, pesticides, etc.

Of course, the choice of a type of development is not, and cannot, always be so clear-cut, but these different possible alternatives do, however, exist. In addition, it may be decided that certain regions or certain types of agricultural production should be developed whereas others should not be developed to the same extent. In other words, it is possible to "plan" the existence of a dual agricultural sector - one part modern and the other more or less left in its traditional state. A policy of gradual but limited improvement may well be applied to the traditional sector or there may be economic and technological reasons for leaving it unchanged for a long period of time.

There are many more possible options with regard to agricultural policy. For instance, a country may decide to make agriculture its main source of exports, i.e. to base its economy on the development of agricultural production for export markets or, on the other hand, make industrialisation its prime objective, in which case agriculture's task becomes that of providing a low cost supply of food for the country's own needs. Once again, the options are rarely so clear-cut but the possibilities for adopting such different policies certainly do exist. For example, the Sudanese agricultural policy, as we shall see, corresponds to the first of these concepts whereas Brazil's agricultural policy more closely resembles the second.

It is important to understand that these different socio-economic options with regard to agricultural development should be reflected in fundamental differences in the type of agricultural training which has to be provided. For this reason, one cannot study a country's agricultural training or assess its value without first of all studying the underlying nature - explicit or implicit - of its agricultural development programme.

The first part of this study therefore is concerned with the general agricultural situation in Sudan. The second part, based on this preliminary study of the problem of agricultural development, should enable us to be specific about the type of output required from the agricultural training system. In other words, it will be concerned with the kinds of training required and the extent of the demand for supervisors and technicians. The third section will therefore be devoted to an analysis of the educational system's output of supervisors and technicians for agriculture. This will be dealt with in this section primarily from a descriptive point of view since the comparison between supply and requirements will form the subject for the fourth and last section. Here, the intention is to highlight the harmony or disharmony which exists between requirements and supply, bearing in mind the type of agricultural development which Sudan has chosen. This disharmony or harmony will need to be analysed from both the quantitative and qualitative aspects. For this to be possible, not only will output projections have to be compared with input projections, but it will also be necessary to analyse factors outside of education itself which are causing a substantial loss of agricultural supervisors and technicians.

The conclusions that one will be able to draw from this study are neither directly usable as norms nor operative procedures. In fact, one of the principle features of this research is its global, macro-social aspect. Its objective is to construct a broad framework within which it will be possible to highlight the problems or rather the categories of problems which could form the subject of subsequent in-depth studies. In this sense, the conclusions will chiefly concern the feasibility of such studies.

This study was carried out by a multi-disciplinary team comprising representatives from the Ministry of Education, the Ministry of the Economy, the Ministry of Planning, the Ministry of Labour and the Ministry of Agriculture, plus an IIEP consultant acting under the supervision of an IIEP project officer.

Appendix 1 gives a list of the members of this team together with details of each one's specific contribution. The work was based on available documents and statistics as well as on numerous conversations with those in charge of agricultural training, agriculture and other ministries concerned at central level. Personal interviews were conducted in several schools in various regions of the country as well as in several of the country's agricultural projects.

A list of the persons interviewed, the schools and agricultural projects visited, together with a list of the documents consulted will be found in the Appendix .

This type of research, involving active participation on the part of officials from the various ministries concerned, revealed the benefits to be gained from such an approach, though it also highlighted its inherent difficulties. The value in terms of the research itself and the motivation of the researchers was fairly substantial since they saw themselves as its direct beneficiaries. Their access to certain types of information - particularly of a qualitative nature - was much easier than would have been the case for professional researchers less familiar with the world of education. However, the lack of specific research training and the fact that these government employees could scarcely be expected to disregard completely their normal duties are factors which make this a relatively inefficient method and, at best, not conducive to a high level of productivity. This of course is one explanation for the limitations and scope of this work. Another is the difficulty in gathering reliable information, either because this does not exist or because it is not sufficiently detailed. A further reason for the limited scope of the results is the material conditions under which the research was carried out, which reflect the the general conditions prevailing in the country - in particular, the major difficulties with regard to transportation, which considerably reduced the research team's mobility.

However, despite these difficulties, we feel that the work accomplished has enabled us to produce a descriptive and analytical framework in which the different problems warranting further study can be put into perspective. This was the main objective of the research.

The quantitative aspects of this report have been based on data available in October 1978. Several changes in the objectives of the Six-Year-Plan which took place during that period, have not been taken into account because relevant information was not made available in due time.

PART I - PROBLEMS AND TECHNICAL POTENTIAL FOR
SUDAN'S AGRICULTURAL DEVELOPMENT

CHAPTER 1

BASIC DATA AND PROBLEMS WITH REGARD TO AGRICULTURE

1. Sudan's natural potential

The different types of training for agriculture and technological progress in this sector are to a large extent conditioned by a country's natural potential and its economic characteristics.

With two and a half million square kilometres, Sudan is the largest country in Africa. It stretches from the Libyan desert and the semi-desert regions of the north to the equatorial forest in the extreme south.

Sudan's population numbers roughly 17 million, which means that population density is very low, i.e. seven inhabitants per km². What is more, this population is far from being evenly spread over the entire country - the bulk of the population is concentrated in the fertile regions south of Khartoum and along the Nile Valley. This meagre population density, which is one of the lowest in the world, and its uneven spread are factors which determine the type of agricultural development which is taking place in Sudan and, by the same token, they will necessarily condition the type of agricultural training and influence technical progress in this area.

Agriculture forms the traditional basis of the economy and Sudanese society. It currently occupies more than 80 per cent of the population and accounts for almost 60 per cent of the gross national product and more than 90 per cent of export earnings. These figures demonstrate the enormous importance of this sector in the economic, social and cultural life of the country. However, although the natural potential of Sudanese agriculture is immense - without any doubt the largest in Africa and amongst the largest in the world - it is far from being fully exploited.

As far as area is concerned, the most up-to-date estimates put the figure at 200 million feddans of cultivable land, i.e. about 80 million hectares. At present, slightly less than 17 million feddans, i.e. ca. 6.8 million hectares, are actually under cultivation. At any one time, roughly 2 million feddans of land (800,000 hectares) are left in fallow and could, through the use of more intensive techniques, be easily put under

permanent cultivation. In total, only 8.5 per cent of the potentially utilisable agricultural land is currently exploited.

In addition, Sudan possesses 57 million hectares of land which could be made suitable for grazing without major capital outlay, plus an equivalent area which could be so used if certain soil conservation measures and grassland improvements were carried out.

The forest covers an area of 218 million feddans but it is only exploited to a limited extent and not very rationally. In total, it is estimated that crop and livestock production could in time be extended to 100 million hectares, which would enable the country to supply its own needs as well as those of the entire Arab world, with which it is linked by tradition, geography and partially by language.

2. Factors limiting agricultural development

If this potential is to be exploited effectively, a number of practical obstacles impeding agricultural development will have to be overcome. Very substantial investments will be needed to eliminate these bottlenecks and these investments will also condition the utility and effectiveness of the cultural factors involved in the technological progress of agriculture, i.e., general and specialised technical education.

There is no doubt that investment should initially be devoted to improving the natural conditions for farming by making greater quantities of water available for irrigation. Under the terms of the 1959 agreement with Egypt, Sudan is entitled to 18.5 bn. m^3 of water from the Nile measured at the Aswan Dam, which in fact represents 20.35 bn. m^3 utilisable on Sudanese territory. Most of this available quantity is already used and there is no doubt that, over the long term, this will prove a considerable obstacle to the development of land for agricultural purposes.

Another substantial obstacle to the development of Sudan's economy and its agricultural sector in particular, is the lack of infrastructures and more especially the dearth of means of communication and transport. The main means of transport is the railway but the network is insufficient (5,500 km) and technically it is inadequate. The network is becoming increasingly unsuited to present requirements. The road network is also very second rate. There are 10,000 km of roads, of which only 5,000 are practicable in all seasons and only 875 km are macadamised. Most of the tracks are unusable during the rainy season and vast regions of the country are cut off from the main centres for 4-6 months of the year. There are about 1,700 km

of navigable waterways and, with some capital investment, many more could be brought into service. In any case, there is at present a great lack of water transport vessels. Sudan also possesses 19 airports usable throughout the year but, here again, the number of aircraft is very inadequate. The country has only one sea port, i.e. Port Sudan, whose capacity is much too small for the country's needs.

This extremely poor communications network makes the transport of capital goods and essential agricultural supplies exceptionally difficult and restricts the movement of persons. It is, for instance, sometimes very difficult, if not impossible, to contemplate cultivating some areas because of the practical impossibility of moving out the produce. In addition, it goes without saying that these shortcomings are the cause of exorbitant rises in the cost of agricultural inputs and outputs.

Aside from the problems of investment and capital formation which are paramount factors affecting the technological progress of agriculture in Sudan, there are considerable problems of administrative organisation and management as well as the problems of training. In Sudan's current stage of economic and social development it would be difficult to envisage the development of agriculture without massive support and intervention on the part of the state. The questions raised by such intervention in the management of agriculture are extremely important but they will not be dealt with here except insofar as they are directly linked to the problem of training supervisors, technicians and skilled workers for the agricultural sector.

However, before coming to grips with this problem, which is the object of this study, one must first of all describe the types of farming practised in Sudan today so as to be able to define the options available with regard to agricultural development, since these to a very great extent condition decisions both with regard to technologies and the type of training required.

CHAPTER 2 THE SYSTEMS OF AGRICULTURAL PRODUCTION

There are three major types of agriculture in Sudan and within these a variety of sub-types. In economic terms, the most important type of farming is irrigated farming, followed by mechanised rain-fed farming and thirdly, the vast so-called "traditional" sector. Each of these types of production has its own specific features and level of productivity, technology and supervision. The number of specialists required now and in the future as well as their type and level of qualification varies in relation to the type of production. The task of planning and forecasting manpower requirements is made even more complex by the diversity of these situations.

1. Irrigated areas

In Sudan as in Egypt, irrigation using the waters of the Nile is a centuries-old tradition. However, modern irrigation for the purposes of commercial production dates from the years 1911 - 1925, the period which saw the construction of the most famous irrigation project - the Gezira Scheme. Today, more than four million feddans of irrigated land is being farmed.

There are three different forms of organisation for the irrigated areas depending on the type of irrigation used.

(a) The Gezira-Managil Scheme

The Gezira area constitutes the largest farm in the world under single management. Today, the scheme covers a total of more than two million feddans, i.e. over 870,000 hectares of irrigated farmland. The Gezira area alone represents 12 per cent of the land under cultivation in Sudan. It produces 75 per cent of the country's principal export, i.e. long-staple cotton, 12 per cent of the country's output of dura (sorghum), 60 per cent of the groundnuts, and 85 per cent of the wheat. A special effort is being made to increase the areas devoted to growing vegetables.

In theory, management of the Gezira Scheme is in the hands of a tripartite association: the Gezira Board, the government and the tenants who number 96,000. In fact, the Gezira Board and the government have the deciding voice. They decide the regulations and crop rotations; they control the farming activities, carry out the mechanised operations and organise the marketing of produce. The tenants perform the manual tasks. A fairly complex system has been set up for sharing the proceeds between the three partners.

Since 1950, a special effort has been made in the social area, particularly in the form of investments directly benefitting the tenants, as well as the setting up of systems for training adults and educating women, financed by the Social Aid Fund and other activities such as the publication of a newspaper, literacy programmes, the introduction of sports for the village youth etc.

(b) The areas managed by the Public Agriculture Production Corporation (PAPC)

In 1967, a large number of the areas managed by the state or by the Agrarian Reform Corporation were put under the sole authority of a newly created body - the Public Agriculture Production Corporation. Today, this very powerful body manages ten irrigated area corporations comprising a total of 2,367,000 feddans, of which 800,000 feddans are controlled by Nuba Mountain Agricultural Corporation and 450,000 by New Halfa Agricultural Corporation.

The various development plans envisage an increase in the number of irrigated areas and by the 1980's there will be an additional two million feddans under irrigation.

The number of irrigated areas controlled by each of these vast corporations may vary from a mere handful to more than a hundred. As a result of this dispersion, technical conditions vary greatly from one area to another.

Most of these areas are fairly small and are in turn divided amongst a large number of tenants. The farming techniques are fairly backward and the cost of managing them would appear to be very high, mainly because of their remoteness from the urban centres and the fact that communications are extremely difficult. At present, some of the areas are profitable whilst others are subsidised.

Cotton is the main crop but other crops are grown for domestic consumption such as wheat, dates, sorghum, beans and horsebeans, citrus fruit and mangoes.

(c) The remaining irrigated areas

There are several thousand small irrigated areas in Sudan which are farmed in the traditional manner by independent farmers. They are small, scattered and remote, which makes state intervention or assistance difficult and in some cases impossible. What is more, their lack of available capital has meant that they are no longer considered worthy of attention. However,

the various services of the Ministry of Agriculture, since they are present in most regions of the country, provide some form of technical assistance, particularly with regard to crop protection. All of these "mini-areas" produce primarily for local consumption.

2. Mechanised farming

(a) Its extent and development

Mechanised farming is a relatively recent innovation in Sudan. The first mechanised farm was in fact set up in 1945 to provide food for the allied armies in East Africa. After a relatively slow start, the mechanisation of agriculture began to gather momentum in the 50s, when the government decided to allot land to private individuals who agreed to clear it themselves. By 1968, more than 1.5 million feddans in the clay soil regions to the west of Gedaref and in the savannah regions had been allotted in this way. In addition, more than 1 million feddans were also being illegally cultivated at this time as part of more or less mechanised farms. During this same year, 1968, the government set up an administrative body to take charge of and assist this type of agriculture as well as to set up and manage state farms in these same regions under the authority of The Mechanised Farming Corporation.

The Mechanised Farming Corporation is a central administrative body which supervises four decentralised regional corporations. The Corporation directly controls the state farms. Where the private sector is concerned, it allots the land, supplies machinery for clearing this land and arranges bank loans. The Corporation also supervises land clearance operations and the regular farming operations; it provides a variety of services, in particular those connected with crop protection.

Mechanised farming is currently practised in four provinces but most widely in the Blue Nile and Kassala provinces. Mechanised farming is expanding at a very rapid rate. In 1973/74, there were about four million feddans under cultivation, which included 321,000 in state farms. One has to take into account the fact that dependence on natural precipitation and the difficulties of maintaining soil fertility means that a substantial proportion of the farmland (about one third) has to be kept fallow. By 1978 these figures had risen to more than six million feddans and 400,000 feddans. The 5.6 million feddans cultivated by independent farmers are divided into some 40-odd mechanised areas. The area farmed by the state is divided into six farms. The main crops are sorghum (dura), sesame and cotton.

(b) Farming techniques

The term "mechanised farm" must not be taken too literally. In fact, this mechanisation is very partial. Land clearance is done by two tractors dragging a heavy chain. The ploughing operation is also mechanised and disk ploughs are used. Sowing, weeding and harvesting are done by hand, although machines are now available which can harvest the current varieties of cotton and cereal crops.

Although it would seem that the availability of a permanent labour force is not a great problem at the moment, it is very likely that this situation will change in the near future, by which time the cost of labour will have risen considerably, following what is already a very marked trend. What is more, there are acute problems with regard to seasonal labour for harvesting, particularly cotton. The situation here is exactly the same as that affecting artificially irrigated farming. This will certainly have important repercussions in terms of the type of technological development appropriate to and planned for Sudanese agriculture and, by the same token, in terms of the type of training given to technical advisory staff and to the farmers themselves.

3. Traditional Farming

What has been termed "traditional farming" is mainly to be found in the regions of West Sudan and more particularly in the Kordofan and Darfur provinces. These regions cover close on a million square kilometres and possess a certain degree of homogeneity in terms of their ecology, climate and plant life as well as in human and cultural terms. The population is of two different types. In the central part, on the mountain slopes and foot slopes, there are numerous non Arab, sedentary communities farming in a traditional manner land which is generally collectively owned. In the north of these regions and in what can be strictly termed the savannah, the inhabitants are breeders of livestock, mainly camels. This population is increasing rapidly and is estimated at between 3.5 and 4 million.

(a) The features of traditional farming

The main feature of so-called "traditional farming" is that, for the most part, it is not market-oriented, i.e. it is monetarised only to a very slight extent. The farmers produce for their personal needs and only a very tiny fraction of their production is destined for the market. This has never amounted to more than 20 per cent of the production - at least until very recently.

One of the consequences of the non-monetary type of farming is that there is no form of capital accumulation as there is with market production. Farm implements are made locally and are fairly primitive.

Land too is only very slowly becoming part of the market economy. In most cases it is communally owned and the village farmers only have a right of usufruct. It can be neither sold nor leased.

A man's labour is not considered a commodity for sale or hire, although there are some signs of the growth of a "proletariat" to which we shall be referring later. However, systems of mutual assistance do exist within the village community framework.

The actual farming techniques are based on a system of plot rotation on communal land and long-term fallow. Each villager is allotted a plot of land which he cultivates for a period of two to three years. When the land begins to show signs of exhaustion, he is given another plot. The one he has just abandoned is allowed to lie fallow for about fifteen years, the time the soil requires to recover its fertility. A system of mixed cropping is practised in order to protect the soil.

(b) Recent trends towards a market-based rural economy

Today, there are signs that Sudanese farming is becoming increasingly market oriented. The main factors responsible for this growth of a market economy would seem to be on the one hand, the growing influence of urban areas with their new patterns of behaviour and consumption and, on the other hand, increasing exposure to new commodities which have to be purchased.

There are two ways in which the rural population can procure the necessary monetary resources to satisfy these needs and both of these have important repercussions on the material and social equilibrium of the traditional way of life. The first of these methods is to increase the amount of land used for growing cash crops whilst the second involves becoming, at least for a time, a member of the "proletariat" and selling one's labour in other regions of the country where there is a demand.

As surveys have shown, wherever possible, farmers prefer the first solution, but this is not always possible and, in any case, is restricted by the availability of land which can be irrigated using archaic techniques. In addition, the system of rotation with long-term fallow requires vast areas and this too limits the amount of land available for increasing cash crop production.

When villages cannot increase the cultivable area, they resort to seasonal migration which tends to disrupt the village's material and social equilibrium in another way, e.g. some villages are beginning to be affected by a lack of manpower at harvest time because this theoretically seasonal migration tends to become prolonged beyond the harvest time in other regions where the demand for labour is high. No doubt the explanation for this long-term migration lies in the remoteness and the problem of communications between West Sudan and the northeastern regions (in particular Gezira and the other large irrigated areas where there is a shortage of labour).

Today, the future for Sudanese agriculture lies mainly in extending the irrigated and mechanised areas. Progress in this direction, however, means coming to grips with the problem of reforming the traditional system of farming. And this vital task can more easily be successfully accomplished if the necessary technical and supervisory staff are available.

PART II - THE SUPERVISORY AND TECHNICAL STAFF REQUIRED FOR
FOR AGRICULTURAL DEVELOPMENT

In order to assess accurately the correlation between the demand for and the supply of agricultural technicians and supervisors, one has to do more than merely compute the number of specialised staff required in global terms. It is important to define the structure of these requirements in terms of levels and types of qualification, bearing in mind the changes which are likely to occur as a result of technological progress. Thus, the real questions to which an answer has to be found are:

How many technicians and supervisors are needed and with what qualifications? What precisely should their knowledge cover? What jobs should they perform and where should they perform them?

In order to supply answers to these questions, both in qualitative as well as in quantitative terms, our analysis of the basic problems of Sudanese agriculture must first of all be completed by an assessment of development plans and prospects in order that we can determine the content of the training required and quantify the needs. This double analysis will form the subject of this second section. It should enable us subsequently to relate the supply of agricultural technicians and supervisors to the system of specialised agricultural training.

CHAPTER 3
SUDAN'S MAIN AGRICULTURAL PROBLEMS
AND THE TECHNOLOGICAL OPTIONS

In view of Sudan's vast potential, there is no doubt that at present its principal economic rôle lies in exploiting its land and that this will remain a priority for the foreseeable future. Not only should agriculture be able to provide food and employment for its population, but in addition it will find a natural outlet if it devotes its attention to exporting to the Arab countries whose agricultural potential is far more restricted. This is borne out by the very important agreements to finance projects concluded between Sudan and certain of the Arab countries.

Furthermore, the logical outcome of such possibilities for development based on agriculture is an emphasis on agricultural products through the development of food processing industries which already constitute an ancillary activity and which should foreshadow and stimulate a broader process of industrialisation in the future.

However, although these broad development prospects for Sudan appear obvious, the same cannot be said of the existing system's substructures. How should agriculture be developed? What technology and what levels of technology should be introduced? What types of supervisor and technician will be needed? Sudan today is attempting to find answers to all of these questions by analysing the major implications of these technological decisions. The solutions which are or will be adopted cannot fail to have very important repercussions on the nature, scope and type of training which will have to be provided to ensure agricultural progress.

1. The problems facing irrigated agriculture and the technological options

Three major technological problems are currently facing the development of irrigated agriculture in Sudan, i.e. the availability of a water supply and the introduction of more modern techniques of using this resource, the availability of labour and, allied to this, mechanisation and lastly, more intensive cultivation through increased use of chemical products and reducing the amount of fallow land. These problems apply not only to the existing areas but also to those yet to be created.

(a) Water resources and modernisation of their use

For many years, one of the main aims of the policy to diversify and intensify Sudanese agriculture has been the increasingly massive use of the waters of the Nile for irrigation. This same policy will apply in the years to come. However, today one is approaching the limit in terms of the volumes of water which the Nile can supply without new structures, whereas the agricultural expansion projects are talking of an area of more than 4,500,000 feddans.

In these conditions, there are two ways of preventing these projects from coming to a standstill in the early 80s. The first of these is to make available new water resources which are currently not being exploited - this is the reason for constructing the Jonglei canal which is designed to supply an additional 4 bn. m³ of water. But even this would appear to be insufficient and it will be absolutely essential to economise on the amount of water currently used in the various projects. For instance, it is now reckoned, that in two years time, the canals in the Gezire-Managil scheme will not be able to supply all the peak water requirements for the various crops.

In addition to widening the canals, less wasteful systems of using water will have to be introduced. It would appear that reducing this wastage involves not only the use of new irrigation techniques but also a revision of the relationships between tenants, management and the state. The present system in fact, which it is not our intention to describe in detail here, is not conducive to a careful and economic utilisation of water, particularly where cotton is concerned. Lastly, it is likely that some of the present crops will have to be replaced - at least partially - by crops which make better use of the available water. With regard to the areas irrigated by pumping, modernisation will involve replacing the old-fashioned gas-oil motor systems by more up-to-date, more refined and more economic methods of irrigation.

However, one should be under no illusions as to the problems involved in introducing such changes and these are not solely a question of available capital. It also involves changing attitudes, improving technical know-how and establishing a system of relationships between farmers and management so that the farmers are persuaded to make better use of water resources and avoid waste.

The types of supervisors and technicians required to put into effect a policy to improve water utilisation are agronomists specialising in hydraulics, i.e. "engineering" specialists and technicians in agricultural engineering; in order to get maximum benefit from the water, considerable work has to be done in the area of plant selection, which means having senior and middle-grade specialists in genetics, capable in particular of carrying out long and patient research in genetics laboratories and plant breeding stations. The technicians required to put this policy into effect will need to be capable not only of designing major projects and preparing overall plans, but also of promoting the use of new techniques by the farmers themselves. What will be of major importance will be these technicians' and supervisors' practical knowledge, and their ability to apply it in the field. Moreover, the intensive supervision which the introduction of refined irrigation techniques requires, means primarily having a good number of middle and junior field staff - really capable of taking charge of irrigation areas, perfecting and disseminating technical procedures, supervising their application by farmers and, where necessary, correcting technical errors. Tasks such as these would normally be assigned to supervisors and technicians trained in agricultural secondary school.

(b) Labour resources and mechanisation

In view of Sudan's vast agricultural potential and its low population density, it is obvious, without making a detailed analysis, that mechanisation is essential to any modernisation and expansion of the country's agricultural production. In fact, the problem of manpower becomes acute whenever any irrigated or mechanised area is created.

In the Gezira Scheme and in the other irrigated areas, the tenants have always been unable to provide the necessary manpower for farming their plots and have to make substantial use of outside labour. The tenants are faced with two major peaks during the farming year: the first in June-September for the ploughing, sowing and weeding, the second in December-February for harvesting the cotton and groundnuts. The regions bordering on the major areas are not able to supply sufficient seasonal labour and manpower has to be recruited from the western provinces, particularly Kordofan and Darfur. In the Gezira Scheme alone some 500,000 temporary seasonal workers are hired every year. For the remaining irrigated areas, the figure is similar.

But today, various factors are making recruitment of these workers increasingly difficult. On the one hand, the new areas brought under cultivation each year reduce the labour supply by attracting former migrants who settle there permanently. In addition, the development of cash crops in the traditional farming regions also tends to diminish the available supply of labour. Lastly, the organisational problems created by this massive migration from distant regions also constitute an obstacle to the development of an agriculture based on the use of a regular wage-earning labour force.

Although there is not yet an overall scarcity of labour for the large irrigated areas, it is certain that the problem will become acute within the next few years. What is more, this reduction in the supply of labour combined with the increased demand is causing a substantial increase in wages and, as a result, an overall rise in production costs. All these factors are more than sufficient argument for an increasing use of mechanisation.

But this would certainly involve changes in farming methods. For example, it has already been decided to reduce production of cotton, despite the fact that this has been the mainstay of Sudan's agriculture and its economy. In fact, it is the crop which requires the most labour for the harvesting operation and is the main cause of the peaks in the demand for manpower. In addition, it is not easy to mechanise. Moreover, world market trends seem to indicate that production of cereals, which is far more easy to mechanise, is becoming a far more interesting proposition than production of textile fibres. As a result, projects aimed at increasing mechanisation are at the same time projects for changing farming structures and crops.

Nowadays, the emphasis is on growing wheat, sorghum and groundnuts. However, the same changes presuppose the development of varieties suited to mechanisation and create considerable problems of genetic research and quality seed production. Lastly, mechanised farming implies training skilled staff and workers with technical skill quite different from those of the traditional farmer.

The same is true with regard to the technologies which are invariably associated with mechanisation programmes. It would be impossible to be without design engineers for drawing up the mechanisation plans, and agronomists specialised in genetics capable of developing long-term research programmes as well as managing seed-growing stations. Mechanised agricultures also implies training soil specialists capable of devising farming methods

which maintain the quality of the land. In view of the scale of the projects to extend mechanised farming, here again the operation to disseminate and apply these new technologies will need to be spearheaded by an army of middle-grade and junior technicians whose function will be to supervise farmers closely - specialised agriculture secondary schools should provide the logical source for such supervisors and technicians.

Whereas the effect of mechanisation is to increase the level of productivity per worker, the use of chemical products primarily increases productivity per unit of land. More extensive and more modern methods of irrigation and the progressive introduction of mechanisation cannot be expected to be really profitable without the use of chemical inputs. For instance, to provide good irrigation for fields which are mostly covered by weeds or partly under cotton, is to waste a considerable amount of water. To use machines to harvest crops damaged by diseases which have been inadequately treated or with low yields due to a lack of fertilizer means similar substantial losses in productivity. Once it has been decided to modernise production, it is vital that all the improvements be carried out at the same time, since in farming, as in many other areas, it is the technological factor with the lowest performance which, in the final analysis, determines the overall level of results and constitutes the decisive factor in raising or lowering production costs.

But, here again, the extensive use of chemical products, aside from the fact that it raises serious financial problems, also creates considerable problems of training. Not only must farmers change their attitudes and increase their know-how, but one will also have to train a large number of specialists in entomology to ensure that pests and insects are strictly controlled, and in agricultural chemistry so that they can carry out soil analyses in the laboratories which will need to be set up. It will also be necessary to train middle-grade staff and technicians capable of analysing, drawing up and implementing practical plans for applying fertilizers, insecticides and pesticides.

2. Traditional agriculture and technological progress

Today, all sorts of inescapable factors are forcing traditional agriculture to change and modernise. Without doubt the two most important factors are the rapid growth in population (2.5 per cent) which is increasing pressure on the land, and the growth of commercial farming which tends to increase the area farmed per person working on the land. Thus, there can be

no question of maintaining much longer a farming system based on long-term fallow, which immobilises vast areas of land for far too long a period, nor of bringing back into use too early land which has been farmed for several years without modifying current methods which almost completely ignore the use of soil nutrients. If production were to be intensified under existing conditions, there would soon be widespread deterioration of the land. The same is true of stockbreeding. The pastureland would already seem to be overcrowded and there are therefore limited possibilities of increasing stockbreeding in the years to come.

If traditional farming is to be modernised, more water will be needed since it currently relies on the uncertain natural precipitation for its needs, in addition, the type of crop and the archaic system of crop rotation leaving land fallow will also have to be radically reformed. What is more, these measures imply a modification in the system of traditional ownership with a view either to introducing the modern concept of private property or some form of co-operative or state ownership within which the new technologies can be applied.

A study carried out in 1975 by a joint ILO/UNDP mission¹, suggested what technical/economic measures could be undertaken to prevent a deterioration in the potential of the traditional farming system and the steps which needed to be taken to intensify production on a rational basis.

To cope with the population pressure and limit the destruction of light and fragile soils, the first immediate action to be taken is:

- to extend the area under cultivation, which implies extending the network of deep wells and hafirs in the savannah zones;
- to use machinery to farm the heavy soils which cannot be cultivated by hand or with a hoe;
- to increase the amount of land cultivated out of season by making use of the clay flood plains;
- to build local drainage systems;
- to palliate the labour problems by using draught animals, wherever soil conditions permit, and by setting up workshops for the manufacture of animal-drawn equipment;
- to reform the laws concerning appropriation and allocate the land to groups or individuals under supervision;

¹Report of the ILO/UNDP employment mission, 1975.

- to improve pasture and the use of pasture resources by digging wells, introduce resistant varieties of grass etc., and eliminate practices which destroy the soil.

Naturally, it would be impossible to carry out a programme of this kind without creating a solid and comprehensive administrative structure with enough authority to devise a comprehensive policy of modernisation, sufficiently decentralised to adapt to local conditions and which, above all, would enable the local population to participate in the process of modernisation. In particular, any change in the system of land ownership which affects traditional farming and grazing rights can only be made with the consent of the people - failing which, the latent antagonism (in particular between farmers and nomadic graziers) can only worsen.

Progress in the traditional farming sector is however not conceivable unless considerable financial resources are allocated to the regions which are to be modernised and unless they are provided with a dense network of supervisory services. The specialisations required cover a very wide range - from the agronomist with a broad, general training to specialists in mechanisation and above all specialists in crop protection. In addition, one should not overlook the need for staff to deal with socio-economic problems, whose tasks would be to encourage the population to accept agricultural progress to assist it in the implementation of the necessary social structures (co-operative groups or other forms of association), and to instruct them in modern methods of farm management and animal husbandry. The staff required for such tasks need to have more than a purely technical training in the strict sense of the word. Amongst other things, they need to be familiar with techniques of management and group leadership, be capable of organising the population around local development projects and communicating to them the essential socio-economic know-how so that they themselves can take charge of these projects. They need to be not only agricultural specialists but group leaders as well.

CHAPTER 4

FORECAST REQUIREMENTS FOR SUPERVISORY AND TECHNICAL STAFF

1. The figures used as a basis in forecasting these requirements

It is only relatively recently that Sudan made its first attempt at drawing up an official plan of manpower requirements for the economy as a whole and for agriculture in particular. It dates in fact from the preparation of the VIth Plan in the years 1976-77. The institutions primarily involved in this activity were the Ministries of Planning, Public Service and Education. For the preparation of the VIth Plan, a special ad hoc interministerial committee was given the task of preparing the manpower analyses and forecasts on the basis of specific plans for production and for the extension of the areas under cultivation.

Broadly speaking, the VIth Plan (1977-1982) is aimed at developing the country's social and economic potential along the same lines as those adopted for the Vth Plan (1972-1977) of which it is the continuation. In other words, agriculture is still considered as the priority sector in the economy. The major policy options adopted with regard to agriculture are the same as those for the previous plan, i.e. to increase production by horizontal and vertical expansion. To achieve this, it is planned to expand mechanised agriculture substantially, integrate agriculture and stockbreeding, improve the productivity of mechanised areas, extend irrigated areas and intensify their cultivation, and improve agricultural services, in particular in the area of crop protection. A special effort will be made to develop traditional agriculture and provide assistance and supervision by increasing the number of staff employed in the Ministry of Agriculture's services; this will include modernising nomadic grazing methods and increasing veterinary protection for livestock, and installing electrical systems of crop irrigation so as to economise on fuel and increase pumping efficiency.

These proposals should, in theory, result in very substantial increases in production judging from the projections contained in the following Tables 1 and 2.

Table 1. Crop production targets: Vith Plan - (Area in thousand feddans, Yield in kgs. per feddan, output in thousand MT)

Product	Base Year 1976/77			Target 1982/83 (Provisional)			Percentage annual increase in output
	Area	Yield	Output	Area	Yield	Output	
1. Cotton							
Long Staple	760	635	483	790	707	559	2.5
Medium Staple	210	500	105	350	849	297	18.9
Short Staple	155	122	19	350	200	70	24.3
Total	1 125	540	607	1 490	621	926	7.3
2. Sorghum (Dura)	6 000	316	1 900	9 100	411	3 740	12.0
3. Wheat	622	500	311	890	750	668	12.6
4. Millet (Dukhn)	2 500	160	400	2 800	185	518	4.4
5. Rice (paddy)	24	500	12	100	570	57	29.7
6. Maize	210	250	53	315	380	120	14.6
7. Cassava	110	1 500	165	180	2 000	360	13.9
8. Sesame	2 200	110	242	2 700	140	378	7.7
9. Groundnut	1 840	456	839	2 900	541	1 568	11.0
10. Coffee	3	500	1.5	15	670	10	37.2
11. Tobacco	1	200	0.2	8	200	1.6	41.4
12. Sugar Cane	40	30 230	1 200	288	30 210	8 700	39.1
13. Horsebeans	36	800	29	55	850	47	8.4

Tea Target is not shown. The present tea area is negligible. It will rise to 6,000 feddans by 1982/83 and production will rise slowly to 1,000 tons in 1982/83.

Source: Sudan, Ministry of National Planning, Six-Year Plan of Economic and Social Development 1977/78-1982/83, Volume 2, Table 3(A), p.7, Khartoum 1977.

Table 2. Production targets for animal products: Vith Plan
(Quantities in thousand MT)

	Actual 1974/75	Base year 1976/77 (Estimates)	1982/83 Targets	Annual rate of increase Percentage
Beef	151	180	305	9.2
Mutton	92	116	169	6.5
Goat	21	25	36	6.3
Camel meat	21	23	30	4.5
Poultry meat	12	15	25	8.9
Fish	24	32	60	11.0
Total meat	321	391	625	8.1
Milk	1 081	1 272	1 730	5.2
Eggs	19	27	58	11.5

Source: As for Table 1 above, Table 3(B) p.8.

The first phase of the Vith Plan is in fact extremely ambitious. It comprises 168 development projects for agriculture and stockbreeding which are divided into three categories:

- on-going projects to which additional funds will be allocated;
- existing projects which need to be consolidated in order to increase productivity (these primarily concern the large irrigated areas and mechanised agriculture);
- new projects for increasing production.

The investments scheduled during the Vith Plan for the various operations involved in these projects are shown in Table 3.

When one considers firstly that the amount of investment scheduled over the next five years is more than three times the amount spent during the previous five years¹ and, secondly that this expenditure only represents a fraction of the total long-term programme drawn up in conjunction with ASPED², one realises that the problem of training technicians, supervisors

¹ Fifth Plan: investments planned - £S209 million; investments actually made - £S146 million.

² Arab States Fund for Economic Development which has agreed to finance part of Sudan's development projects over a period of 15 years.

Table 3. Breakdown of public sector investments - Vith Plan (agriculture) (£S000)

	<u>Sub-Sectors</u>				<u>Total</u>	
	<u>Services</u>	<u>Crops</u>	<u>Irrigation</u>	<u>Livestock</u>	<u>Amount</u>	<u>Percentage</u>
On-going projects	28,276	16,858	38,877	7,575	91,586	21.6
Existing projects consolidation	14,075	48,168	-	1,556	63,799	15.0
New projects	28,923	78,354	116,300	46,038	269,615	63.4
Total	71,274	143,380	155,177	55,169	425,000	100.0

Source: As for Table 1, Table 5, p.16

and skilled workers for the coming years will constitute a decisive factor in the development and technological progress of Sudanese agriculture which will require technical assistance and services on a scale which bears no comparison with the current and already critical situation.

Despite the committee's efforts and the assistance provided by officials from the various Ministries, their findings were only of a very general nature. The prime reason for this is the lack of adequate statistical facilities, the dearth of available information and the enormous difficulties in organising surveys - in particular, the lack of staff to do such research work and, above all, the lack of funds.

As a result, the forecasting techniques used were fairly simple. For the most part, they were based on the guidelines suggested by the United Nations for estimating long-term needs for supervisors, technical staff and skilled workers.

In concrete terms, requirements were estimated on the following basis:

- one agronomist per 12,500 hectares of irrigated land or per 25,000 hectares of non-irrigated land;
- per agronomist: three senior technicians and ten skilled workers, i.e. tractor drivers, mechanics, laboratory assistance etc. If these ratios are applied to the area under cultivation at present, it will be seen that Sudan is very much below the United Nations' standards.

In 1973, there were in all 789 agronomists and veterinarians, 295 senior agricultural technicians and about 490 skilled agricultural workers. Based on the irrigated and non-irrigated areas under cultivation at the time, this meant that only 35 per cent of agriculture's requirements were covered in the case of engineers and veterinarians and less than 5 per cent in the case of skilled workers¹.

2. Total requirements

If these same ratios are applied to the total area which is scheduled to be brought under cultivation during the course of the Vth Plan, the manpower requirement will be seen to be very substantial.

By 1982/83 the area under cultivation is expected to amount to 4.1 million feddans of irrigated land and 18.4 million feddans of non-irrigated land, i.e. mechanised and traditional farming (see Table 4 below).

¹ Figures supplied by the Ministry of Planning.

Table 4. Area under cultivation during the Vith Plan (Millions of feddans)

Year	Irrigated	Irrigated
1976/77	2.8	12.2
1977/78	3.0	13.0
1978/79	3.2	14.0
1979/80	3.4	15.0
1980/81	3.6	16.0
1981/82	3.9	17.1
1982/83	4.1	18.4

Source: Ministry of Planning

On the basis of these figures and taking into account existing supervisors and technicians¹, the Ministry of Planning has estimated the number of additional supervisors and technicians of different levels who will be needed over the period 1977-1982. These figures are given in Table 5.

It will be seen that the heaviest demand and the most substantial need, will be for the lower grades of skilled staff, i.e. those who, on a daily basis, are directly involved in farming operations. As our analysis of the obstacles to technological progress in Sudanese agriculture might have led us to expect, we shall shortly be discovering that it is precisely at this level that the supply will be the most inadequate and the shortfall the largest in quantitative terms.

3. The requirements in qualitative terms

Because of its global character, this type of forecast of requirements has major shortcomings - in particular, that of ignoring the qualitative aspect of these requirements. It does not allow us to specify what type of specialist training should be given to each category of technical and supervisory staff.

In fact, what the agriculture and livestock services actually need is not 5,000 agronomists nor 15,000 skilled workers, etc. The real requirement for their development projects is a specific number of entomologists, a specific number of technicians capable of carrying out soil analyses and saying what type of fertilizer should be used, a specific number of specialists in agricultural equipment, tractor drivers, laboratory assistants etc. The only way to arrive at this kind of detailed breakdown is to base the planning of

¹Or rather those we presume exist, since there are no complete figures available.

Table 5. Projection of Supply and demand for professionals, technicians, and skilled labour during the Vith Plan, 1977/78-1982/83

<u>Specialization</u>	<u>Demand</u>	<u>Supply</u>	<u>Deficit</u>
<u>Professionals</u>			
Agriculturists	5 000	2 660	2 340
Veterinary Doctors	2 200	1 000	1 200
<u>Technicians</u>			
Agriculture, and Forestry	5 000	2 150	2 850
Veterinary	2 000	580	1 420
<u>Assistant Technicians</u>			
Agriculture, Forestry and Veterinary	4 000	1 800	2 200
<u>Skilled Labour</u>			
Agriculture	15 000	4 000	11 000

Source: Sudan, Ministry of National Planning. Six-Year Plan of Economic and Social Development, 1977/78-1982/83. Volume 1, pp.105-7.

requirements for technical and supervisory staff on the specific technology involved in each project - in other words, an individual and localised micro-planning for each project. For several reasons it is not currently possible to collect such basic data in Sudan: firstly, because of the inadequate statistical data secondly, because of the difficulty of defining the specific requirements of a particular project and, lastly, because of the often uncertain future of some of them - particularly with regard to their financing.

As we shall see, one of the consequences of this difficulty in specifying the exact nature of requirements for technical and supervisory staff is that it is difficult to determine precisely what should be the content of curricula in the schools, colleges and faculties. It is for this reason - primarily - that these are very broad and have a very marked academic bias.

PART III - THE PROVISION OF AGRICULTURAL SUPERVISORS,
TECHNICIANS, AND SKILLED WORKERS BY THE
SYSTEM OF EDUCATION

Like many other young countries which have decided to base their social and economic development on agriculture, Sudan has not planned from scratch an educational system designed to provide the necessary human infrastructure for this development. In Sudan, the system of agricultural education has been created on a very empirical basis, more in the form of stop-gap measures than a real analysis of requirements. This has produced many problems and inconsistencies and attempts have been made to remedy these as they occurred. Nonetheless, past events in the building of the system of agricultural education have produced a structure which bears the imprint of the empiricism which accompanied its creation. This third section will be devoted to a description of this system for producing technical and supervisory staff for agriculture so that, in the following section, a comparison can be made between the supply and the demand.

CHAPTER 5
THE PLACE OF AGRICULTURAL EDUCATION WITHIN
THE GENERAL SYSTEM OF EDUCATION

1. The structure of the education system

Since the 1971 reform, education has been divided into three levels: primary, secondary and higher. Both primary and secondary education last six years, but secondary education is divided into two separate periods of three years, i.e. junior secondary and senior secondary.

Professional agricultural training is part of the senior secondary cycle but lasts four years and, for this reason, is often termed "post-secondary". However, some aspects of agricultural training are included in the curricula for the primary level.

University courses vary in length depending on the subject-matter and the individual university. The colleges and higher institutes of agriculture in the province of Khartoum form part of the Khartoum Polytechnic.

Aside from this formal structure, there are various systems of non-formal education - in particular, where agricultural education is concerned, the integrated rural education centres which are, however, still in the project stage. The following diagram shows the overall structure of Sudan's present-day education system and the place of agricultural education with this system.

The complete system of technical agricultural education in 1979 is as follows:

- Centres of instruction and vocational education

Training centre for farmers' sons at Barakat,

Training centre for farmers' sons at Masaad,

Training centre for machine operators and tractor drivers at Tozi.

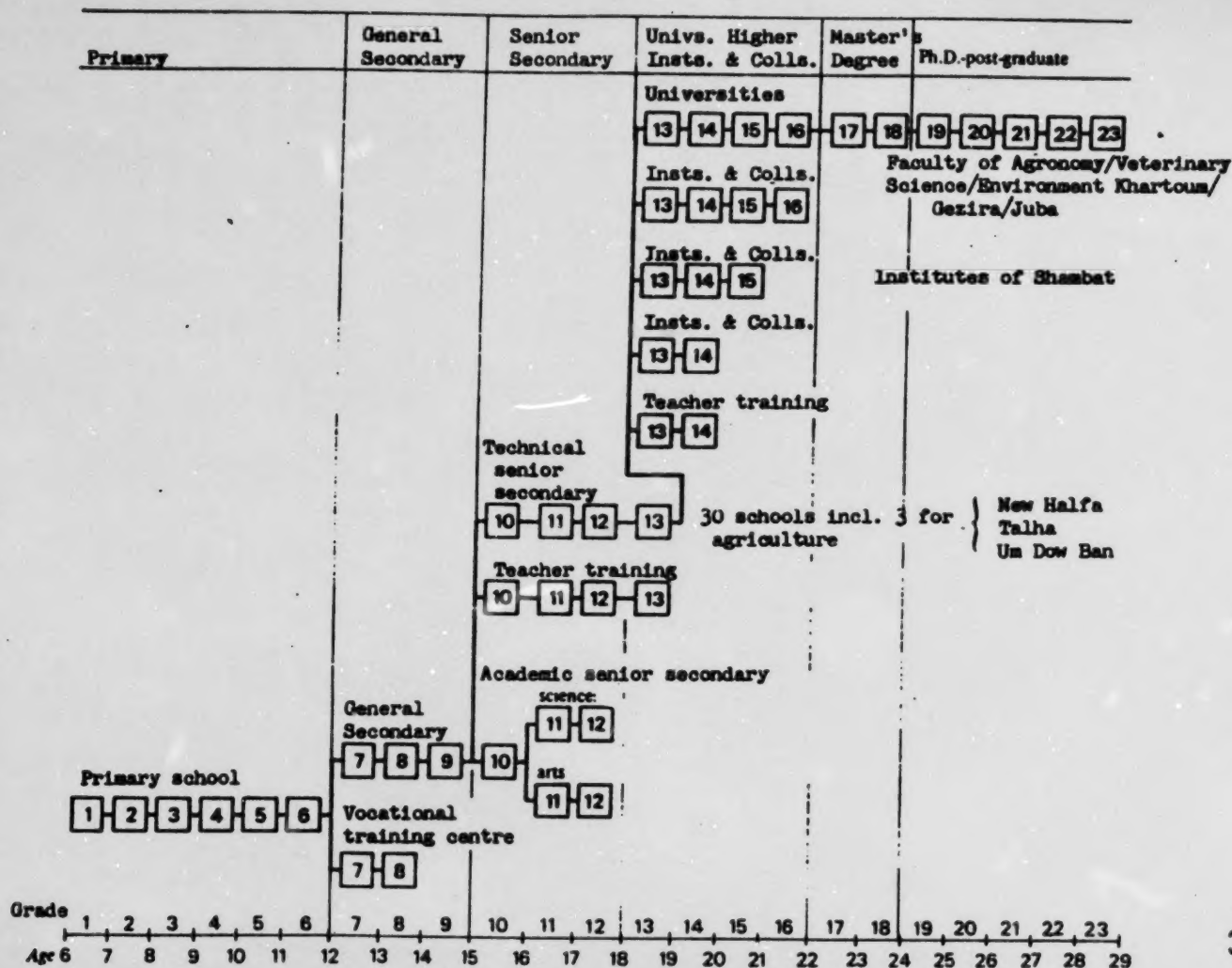
- Senior secondary technical education (agricultural schools)

New Halfa,

Talha,

Um Dow Ban.

Figure 1. Sudan's Education System



- Higher/Post-Secondary Education

Khartoum Polytechnic

(a) College of Agricultural Studies, consisting of:

- . Shambat Division for agriculture
- . Kuhn Division for veterinary science and stockrearing
- . Soba Division for forestry

(b) Affiliated Agricultural Colleges

- . Abu Naama College of Agriculture and Natural Resources
Blue Nile Province (1977/78)
- . Abu Haraz College of Agriculture and Natural Resources -
Gezire Province (1978/79)

- Higher Education (Universities)

Khartoum University Agriculture Faculty (at Shambat)

Faculty of Veterinary Science and Stockbreeding (at Shambat)

Faculty of Gezira University (Agronomy)

Faculty of Juba University (Agriculture and Environment)

If the objectives of the VIth Plan are achieved, between the years 1977/78 and 1982/83, 64 new technical schools will be opened, 14 of which will be agricultural schools. However, as of now, it looks as if it will be difficult to achieve these targets because of a foreseeable lack of finance.

2. A brief history of agricultural education in Sudan

Although for many years Sudan's development has been based on agriculture, a regular system for producing the number of trained specialists required in this sector has never really existed. This is evidenced by the repeated closure of certain schools which were opened during the years prior to Sudan's independence. The reasons were either the lack of facilities (financial resources in particular), a lack of jobs for graduates and school-leavers, political problems, or the fact that the subject matter taught did not correspond to the requirements of Sudanese agriculture.

The technical schools and training centres were set up without there being any clear definition of their real purpose, the type of training they should provide and the numbers of specialists they should produce.

The closing of middle-level and junior schools coupled with the unpopularity of this type of school amongst students has created considerable imbalances between the different grades of specialist. Consequently, the pyramid of agricultural specialists has been top-heavy from the outset with

a relatively large number of university graduates and an insufficient 33
number of middle and junior grades, who are those actually responsible for
operations in the field. The effects of this top-heaviness are still very
marked even today since the biggest shortages are for this intermediate
type of staff. This fact needs to be emphasised because it conditions to a
very large extent the ease or difficulty of achieving real technological
progress in agriculture.

Ever since the beginning of independence, the Minister of Agriculture
has spoken of the increasingly obvious need to train more qualified staff
for agriculture. This resulted in the creation in 1954 of an intermediate
level institute at Shambat, the purpose of which was to train agricultural
technicians who would work in close contact with farmers in the private
sector, but who would also have sufficient practical and theoretical know-
ledge to take charge of small agricultural projects. Later, in 1973, the
Institute was transferred to the Department of Higher Education. In 1975
it became a division of the College of Agricultural Studies and part of the
Khartoum Polytechnic.

The enormous expansion of irrigated farming and mechanisation at
the end of the fifties led to the setting up in 1963 by the Ministry of
Agriculture of a centre for instruction and training in the operation of
machinery at Tozi in the province of the Blue Nile. Here, six-month courses
in the operation of tractors and farm machinery are given to youngsters aged
between 18 and 21, for whom the only qualification required is an ability to
read and write. More recently, the course was extended to a year.

In 1971, at the same time as the entire Sudanese system of education
was being recast, the government decided to create three new agricultural
secondary schools: one at New Halfa, in the province of Gezira and the
third, not set up until 1975, at Um Dow Ban, in the province of Khartoum.
Earlier, but still as part of the reform of education which was about to
be introduced, a Higher Institute of Veterinary Science and Livestock
Resources was set up at Kuku in the province of Khartoum. By 1970, students
who had already received 12 years of general education were being given a
two-year course of instruction. In 1975, the Institute became a division of
the College of Agricultural Studies and part of the Khartoum Polytechnic and
courses were extended to three years.
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being given a two-year course of instruction. In 1975, the Institute became a
division of the College of Agricultural Studies and part of the Khartoum
Polytechnic and courses were extended to three years. 4/1

Lastly, in 1972, a start was made on the building of two Agricultural Institutes, one at Abu Haraz in the province of Gezira and the other at Abu-Naama in the province of the Blue Nile. Delays caused by financial problems meant that they were not able to open their doors until 1978. These institutes have the same status as the one at Shambat. The one at Abu Haraz will concentrate on the techniques of irrigated agriculture and mechanisation as practised in the Gezira area. The Abu-Naama Institute will concentrate on courses dealing with irrigated agriculture and animal production.

In 1975, the building of two new faculties of agriculture was begun - one at Juba in the province of Equatoria, which has not yet opened its doors, and the other at Wad Medani in the province of Gezira, which will be recruiting its first students in 1979.

The 1971 reform was the beginning of an important phase in the development of Sudanese agriculture. Broadly speaking, it can be said that, prior to this reform, agricultural education in Sudan was of a markedly academic nature. It led either to a university or to an office job. There were very few truly technical schools which managed to survive. The new education policy adopted at that time emphasises the need for truly technical and vocational training. However, as we shall see in the later Chapters, it would seem very difficult to make the transition from a predominantly academic education to a predominantly technical education in the strict sense of the term. However, there is an obvious awareness of the need to make this transition.

3. Agricultural instruction in general schools

As part of the plan to emphasise development-oriented education, Sudan has made a special effort to create an awareness of farming questions amongst younger school children. Biology lessons, for instance, are part of the primary school curriculum. In the fifth and sixth primary grades, the programme includes lessons on farming as such. Some schools - albeit a few - have a demonstration plot and sometimes even a farm where pupils can put into practice some of the theoretical knowledge they have acquired.

Nor is farming overlooked in urban areas since not only does the curriculum include the same lessons about farming, but several of these schools, too, have a demonstration plot.

However, despite these commendable efforts, primary education cannot of course be expected - nor is it intended - to contribute directly to the training of future agricultural technicians. ⁴²

Agricultural education also plays an important rôle at the general secondary level. Prior to the 1971 reform, for example, there were 25 intermediate technical schools spread throughout the country and a quarter of these specialised in agriculture. However, following the publication in 1966 of a report prepared by the National Committee on Education with the help of international experts, it was decided gradually to eliminate this type of education at the general secondary level, both with a view to harmonising the educational cycles and for practical reasons of which the most important are worth mentioning.

First of all, it was not considered reasonable to orient children towards a particular specialisation at such a young age. In this connection, the report stated that children beginning their secondary education were not sufficiently mature at that age to choose their future career.

Moreover, it was found that, as still happens today at other levels, selection and orientation towards technical secondary education were not based on the aptitudes and real wishes of those concerned but were the result of their inability to gain access to academic education as such. So in fact the children who were entering technical secondary education were those who had failed the entrance examinations for general and academic secondary education.

From a practical point of view, it was also found that the children were not capable of properly using laboratory equipment and, in particular, farm implements designed for adults.

However, the decision to do away with this form of education did not mean bringing to an end the attempt to create an awareness of agriculture at the general secondary level. On the contrary - an effort in this direction has been made even at the primary school level. Students in general secondary schools are now given practical instruction in domestic science, crafts and rural education. A number of these schools too have a demonstration plot or even a farm where the students can practise farming operations. But, here again, it should be stated that this type of instruction is intended to do no more than make students aware of the rural world around them and not to provide them with a thorough and systematic training in agriculture.

CHAPTER 6
AGRICULTURAL INSTRUCTION AT THE SENIOR
SECONDARY LEVEL

The three senior secondary agricultural schools are located in rural areas and originally they were designed to train students and adults from the neighbouring regions. The first two of these schools were set up in 1971-72 at the time of the education reform; these are the schools at New Halfa and Talha in the northern provinces. The courses last four years. Since 1974-75, each school has had a total of 9 to 10 streams. The third agricultural school at Um Dow Ban, which is near Khartoum, has 8 streams. Each stream comprises about 50 students.

1. The aims of agricultural education

The primary function assigned by the state to these senior secondary agricultural schools is to train technicians capable of supervising farming operations and carrying out the actual fieldwork on the farm. The object is to train operational field technicians in the strict sense of the term, capable of operating or supervising the operation of agricultural machinery and making proper use of all the aids to agriculture provided by modern chemistry.

From the socio-cultural point of view, these schools were intended to act as a means of curbing the rural exodus, since it was hoped that a large majority of these trained technicians would, on their own initiative, take up farming as a profession. To all intents and purposes, the curriculum is designed with this object in mind. Courses are provided in animal production, crop production, soil conservation, rural economy, extensive and intensive breeding of large animals, forestry, the making of food products, farm mechanisation and, lastly, farm management and administration. However, in actual fact, although the schools do turn out agricultural technicians, it can certainly not be said that the aims of the authorities in setting them up have been achieved. The rural exodus has not diminished and these technicians have not become farmers.

Table 6. The number of streams in agricultural schools¹

	Halfa				El Talha				Um Dow Ban			
	Number of streams											
	1st	2nd	3rd	4th	1st	2nd	3rd	4th	1st	2nd	3rd	4th
1971/72	4				2							
1972/73	1	4	4		3	2						
1973/74	3	1	4	4	2	3	2					
1974/75	2	3	1	4	2	2	3	2				
1975/76	3	2	3	1	3	2	2	3	2			
1976/77	2	3	2	3	3	3	2	2	2	2		
1977/78	2	2	3	2	2	3	3	2	2	2	2	
1978/79	3	2	2	3	2	2	3	3	2	2	2	2

¹ From the Chart in the office of agricultural specialists - Ministry of Education.

2. The technical qualification of students trained at agricultural schools

Surveys carried out in the three schools, and in particular at the one in Talha (Gezira province), indicate that the general practice is to establish agricultural schools close to development projects and in rural areas.

All subjects are taught in Arabic, using textbooks imported from neighbouring Arab countries. In addition students have the opportunity of field training, but more machinery and equipment are needed to facilitate this practice.

The timetable shown below indicates that out of the total of 1,260 periods per annum, 600 or 48 per cent are for agricultural subjects, while 660 or 52 per cent are for academic subjects.

Table 7. The timetable in agricultural secondary schools
(Periods per annum - 45 minutes per period,
42 periods per week,
30 weeks per year).

	1st year	2nd year	3rd year	4th year
<u>Academic Subjects</u>				
Arabic	90	90	120	120
English	90	90	120	120
Religion	60	60	30	30
Social Subjects	60	60	30	30
Elementary Maths.	120	120	120	120
Elementary Science	240	180	120	120
<u>Agricultural Subjects</u>				
Farming	240	210	120	120
Horticulture	210	210	120	120
Agricultural Economy and Guidance	-	-	60	60
Hygiene and Animal Production	-	120	180	180
Milk Industries	-	-	120	120
Food Industries	-	-	120	120
Agricultural Engineering	150	120	-	-
	1 260	1 260	1 260	1 260

Source: Ministry of Education, Khartoum.

3. The figures for enrolment

The figures for total enrolment given below have been provided by the Ministry of Education and the research team. The trends in the number of students enrolled in each of the three senior secondary agricultural schools and total enrolment for these schools are shown in the following four Tables 8 - 9 - 10 - 11.

A study based on the same statistics shows that wastage on transition from one grade to the next occurs mainly in the second grade. There are hardly any repeaters in the third grade. However, most of the drop-outs in the agricultural schools occur at the time of transition from the third to the fourth grade. In fact, out of an average annual enrolment

Table 8. Enrolment in El Talha agricultural school

Year	1st grade	2nd grade	3rd grade	4th grade	Total
1972/73	154	105	-	-	259
1973/74	100	150	130	-	380
1974/75	104	100	150	103	457
1975/76	173	107	95	135	500
1976/77	185	163	107	95	550
1977/78	133	190	161	109	593
1978/79	-	-	-	-	-

Table 9. Enrolment in Halfa agricultural school

1st grade	2nd grade	3rd grade	4th grade	Total
49	197	-	-	246
150	53	195	-	398
94	150	53	193	490
150	96	150	53	449
119	154	101	138	512
110	118	158	99	485
-	-	-	-	-

Table 10. Enrolment in Um Dow Ban Agricultural school

Year	1st grade	2nd grade	3rd grade	4th grade	Total
1972/73	-	-	-	-	-
1973/74	-	-	-	-	-
1974/75	-	-	-	-	-
1975/76	128	-	-	-	128
1976/77	124	122	-	-	246
1977/78	124	120	120	-	364
1978/79	125	120	124	120	489

Table 11. Enrolment in agricultural schools

1st grade	2nd grade	3rd grade	4th grade	Total
203	302	-	-	405
250	203	325	-	778
198	250	203	296	947
451	203	245	188	1 087
428	439	208	233	1 308
367	428	439	208	1 442
-	-	-	-	-

Source: Statistical notebook - Ministry of Education.

of 311 students between the years 1972/73 and 1977/78, only 230 completed their studies. Most people seem to share the opinion that this drop-out phenomenon is due to the number of students wishing to abandon technical education.

Students who have succeeded in passing the third grade can sit an examination for the "Sudan Certificate" like their counterparts in the academic cycle. Those who succeed in obtaining this certificate can seek admission to a university or an institute of higher education.

Although the total number enrolled each year is increasing, there has been a certain levelling off over the past two years. Total enrolment is however much below the figure planned by the Ministry of Education. This is largely due to the failure during the VIth Plan to open new streams in the agricultural technical schools.

4. The achievement of targets for the number of streams to be opened

During the period 1974-77, it was planned to open 135 new streams, i.e. 24 for teacher training, 38 for general academic education and 73 for vocational training. Of the 73 vocational streams, 30 were for agriculture.

In reality, during this period, 62 rather than 38 general academic education streams were opened and 13 vocational streams instead of 73, including only 4 for agriculture instead of 30, i.e. less than 10 per cent. Table 12 gives details of the Plan's targets and achievements. It is hardly likely that the target/achievement ratio will show any significant improvement from now to the end of the VIth Plan to allow for this backlog to be made up. The disparity between forecasts and fact are fairly substantial and are due as much to financial as to cultural reasons.

First of all, one discovers that the departments responsible have practical difficulties in spending the budgets allocated for creating schools. For example, during the period in question, only 35 per cent of the budget allocated for the creation of general academic streams was actually expended and only 28 per cent of the budget for new vocational streams (see Table 13). This problem apparently occurs at every level of the administrative machinery dealing with education and is evidence of the organisational deficiencies whose effects are reflected in the pace and level of the country's technological development.

Table 12. The high secondary level Plan - Construction of streams - 1973/74 - 1976/77

Plan 1973/74 1976/77	Academic streams	Commercial streams	Vocational streams	Agriculture streams	Vocational for girls	Training	Total	Annual plan for expansion of streams	Percentage of accomplishment	General Note
1973/74	Government	4	2	-	9	24	15			Total and percentage are for both academic and vocational education (vertical line)
	Shahi	2	-	-	-	-	14	25	56	
1974/75	Government	-	-	-	1	-	15	30	50	
	Shahi	-	-	-	-	-	-	-	-	
1975/76	Government	-	-	-	-	8	54	36	150	For the horizontal line the percentage shows expansion of the academic education and the failure of the vocational plan
	Shahi	34	-	-	-	-	-	-	-	
What is accomplished until 1975/76		62	6	2	4	1	83	94	94	
Expected to be accomplished in 1976/77		-	2	6	2	2	14	44	51	
TOTAL		62	8	8	6	3	10	97	135	71
Transfer to the Six-year Plan		-	-	12	24	6	14	62	-	-
Percentage of what is accomplished		162 %	100 %	30 %	20 %	32 %	41 %	85 %	-	-

SOURCE: Ministry of Education: Shaf'i Saad El Amal El Maralla, 1973/74 - 1976/77, Chartom, 1976, p. 30.

Table 13. The budget of general education - 1973/74 - 1974/75 (£S)

Year		Primary	General secondary level	Higher secondary level vocational and academic
1973/74	Allocation	750 000	300 000	528 000
	Expenditure	348 834	150 000	190 000
	Percentage of allocation spent	46%	50%	35%
1974/75	Allocation	3 216 525	1 672 830	2 579 840
	Expenditure	1 085 775	640 575	726 642
	Percentage of allocation spent	33.7%	38.3%	28.2%
<u>Source:</u> Ministry of Education, Tanfiz Bnamg El Amal El Marhalia, Khartoum 1976, p.12.				

5. Conditions affecting the expansion of agricultural technical education

Despite the authorities' desire to encourage the expansion of vocational education and, in particular, agricultural education, one finds that this is facing considerable challenges. A series of interviews and discussions with educational specialists revealed a number of reasons for this.

The lack of social prestige associated with technical education is not something which affects only the students - it is equally apparent in the attitude of the population and the local municipal and village authorities who are involved in decisions to build schools and create new streams. The low prestige of technical education is related not only to levels of remuneration but also to the fact that "progress" in the eyes of farmers who send their children to school is, based on their own personal experience, something to be sought outside of farming.

This negative view pervades every level of education. For example, according to a scale of values drawn up by the administrative staff of the Faculty of Agriculture at Khartoum University, medicine and chemistry are given the highest prestige rating whilst the lowest ratings, in descending

order, are for agriculture, veterinary science and general science. As mentioned earlier, this state of affairs is naturally not without influence on the quality of enrolment in the various faculties.

At the local level, the lack of prestige associated with agricultural education results in a greater emphasis being placed on developing general academic education rather than agricultural education. Of the 62 new streams of general academic education created during the period 1974-77, 48 were created by local authorities independently of the Ministry of Education's Plan, but not one single vocational school. But, against these considerations, it must also be noted that in 1979/80 there were some 2,000 applicants for the 300 places made available in agricultural secondary schools.

Aside from cultural reasons, there are financial constraints. For example, the cost of building technical schools is far higher than that for vocational schools.

In addition, the Ministry of Education has calculated that costs per student are five times as high for an agricultural technical school as they are for a general academic school. This high cost seems to be due mainly to the need to set up laboratories with expensive equipment, the purchase of agricultural machinery for demonstration purposes and the costs of running the demonstration "farms" that such schools need to have.

Another reason given is the lack of suitably qualified teachers - this being partly related to the technical teacher's inferior social status. Because of the difficulties of finding qualified Sudanese teachers, many schools have resorted to recruiting technical teachers from other countries, Egypt in particular. In most of Sudan's agricultural schools, at least 50 per cent of the teachers are Egyptian.

According to the survey carried out by the Administrative Staff of the Faculty of Agriculture at Khartoum University, this has certain negative effects on the content of the teaching. This is not a reflection on the competence of these foreign teachers but, is because the knowledge which they have gained in Egypt and which they impart to their Sudanese students does not always entirely relate to local conditions. Substantial anomalies then begin to appear in the curricula and emphasis is placed on aspects which are inapplicable to Sudan. The situation is made worse by the non-existence of textbooks on farming dealing with local conditions, and by the use of books and documents which are all of foreign origin.

Lastly, as mentioned earlier, many graduates from the agricultural technical schools do not find a job in government departments or, if they find one, they are not satisfied with it because it would seem that in many cases this does not really correspond with their qualifications. Added to this is the fact that these graduates do not regard the salary scales and career prospects as either satisfactory or fair. Under these circumstances, students find no attraction in technical education and do all in their power to avoid it and enrol in the academic cycle. In fact, one is tempted to think that in Sudan the only students who take a technical agricultural course are either those who, despite all their efforts, have not succeeded in gaining admittance to general secondary education or who lack the wherewithal to do so. The deliberate choice of agricultural studies as a vocation must therefore be considered the exception.

Despite the government's efforts and its avowed intent to give high priority to vocational technical education in general and to agricultural education in particular, there is every reason to believe that the conditions described above will continue for some considerable time and that it will prove extremely difficult to reverse the trend. It is in fact more a question of socio-cultural climate than practical decisions. Considerable efforts will need to be made, and not only in the area of education, to upgrade agricultural education socially, culturally and economically in order to obtain a satisfactory output of technical staff, particularly at the intermediate level.

CHAPTER 7

THE HIGHER INSTITUTES OF AGRICULTURE

1. The Shambat Institute

The Shambat Institute of Agriculture is the largest of Sudan's current total of five higher institutes of agriculture. Of the 1,200 technicians in the country's agricultural development services, 800 are from Shambat. The Institute's objective is to train technicians of a good standard, capable of supervising and implementing agricultural development plans and particularly the major projects scheduled for the future. Their task is not only to supervise operations on farms managed by some form of state or semi-state institution, but also to act as advisers to farmers who have to be taught modern methods of farming and stockbreeding.

(a) The curricula

The Shambat Institute's curriculum, like those of the agricultural secondary schools, might well be termed semi-academic. With its fairly general character, it is more a training for office jobs than for the practical work of a farm technician. A technical committee set up in 1975 to analyse curricula stated that, although the Institute appeared to be operating satisfactorily, it had not yet reached the desired standard with regard to the practical work assigned to students.

The survey carried out by the research team revealed that the reasons for this were practically the same as those which apply in the case of the agricultural secondary schools, i.e. all of the teaching is done in English using American or English textbooks and material. There is hardly one course which is specifically Sudanese in origin.

The question of funds is a crucial problem as far as equipment and practical work are concerned. One notes in fact that the budget for 1978/79 is practically the same as the one five years earlier, but, whereas in 1973/74, a tractor cost £\$2,000, its price in 1978 was £\$5,000. As a result of these budget restrictions, funds for machinery, laboratory equipment, etc. have been severely curtailed. Although the Institute has a demonstration farm of 130 feddans, it is for these reasons very difficult to work more than 30 feddans.

As far as the level of practical training is concerned, it would seem that the major problem arising from these budget restrictions is the impossibility of raising the level of the Institute's farming technology to match that actually used, or that one would like to see being used, in Sudanese

agriculture. This not only applies for mechanical equipment but for all the practical operations of stockbreeding. With the present availability of funds, it would seem practically impossible to teach students the modern techniques of animal breeding and nutrition with the possible exception of poultry farming.

However, aside from budget restrictions, it would seem that the basic problem affecting training at the Shambat Institute is that of specialisation: there is no doubt that the encyclopaedic nature of the curriculum results in a dispersion of effort and a dilution of subject matter and thus constitutes one of the reasons for the difficulties in intensifying practical work.

This state of affairs has not escaped the attention of those responsible for technical education in Sudan who would like to increase the specialisation of the various institutions providing technical education. The Abu Harz Institute for example, which is in the Gezira area and which has just opened, will specialise in mechanised farming using natural hydraulic resources. In the case of Shambat it has not yet been decided in what way the curriculum should be pruned and what specialisation should be adopted.

(b) Enrolment

Over the period from 1972/73 to 1978/79, the intake averaged 113 students per year whilst those receiving degrees numbered 106. It should however be said that, as from 1975/76 enrolment has dropped sharply. The main reason for this has been the freezing of operating budgets at a time when the cost of living was rising sharply, e.g. in 1974, it cost £S40,000 to feed 360 students, whereas in 1978/79 the cost had more than doubled. As a result, the Institute has been obliged to restrict enrolment and this has never regained its 1974 and 1975 levels of respectively 127 and 128 students (see Table 14).

The greatest number of drop-outs occurs with the transfer from the first to the second grade. The number was particularly high for the school year 1977/78 when it amounted to one third of those due to transfer from one grade to the next. The reasons for these drop-outs are more or less the same as those for all the agricultural schools. Many of the students do not wish to become agricultural technicians and are enrolled in a technical institute because they were unable to obtain direct entry to a university. However, they do not give up hope of becoming university graduates and, to this end, a few of them resit the examinations for the Sudan Certificate,

which gives them direct access to a university and they will do this even during their first year at the Shambat Institute.

Whatever the truth of the matter is, roughly one third of the students who leave or abandon their studies at the Shambat Institute enter or attempt to gain admission to universities at home or abroad. This is a fact one cannot ignore when attempting to assess the number of middle-level technicians which the country will have available to start its ambitious agricultural development projects.

Table 14. Enrolment in Shambat Institute of agriculture

Year	1st grade	2nd grade	3rd grade	Total	Graduates
1972/73	124	132	110	366	110
1973/74	128	96	127	351	124
1974/75	136	107	94	337	94
1975/76	97	117	104	318	102
1976/77	118	94	116	328	115
1977/78	95	83	92	270	93
1978/79	105	81	83	269	83

Source: Statistics of Higher Education. Records on Shambat Institute.

2. The Soba and Kuku Institutes

The Soba Institute, which is also part of the polytechnic, trains forest rangers whose job it is to maintain forest resources, develop production of certain products like gum arabic for which Sudan is one of the world's major sources of supply, and prevent land from becoming desert. They also have the difficult task of making the country self-sufficient in timber.

Until recently, enrolment for the Forest Rangers College was every two years, now it is every three years. Table 15 shows that the intake has remained relatively stable. One notes that practically all the students admitted gain their diploma and there are hardly any drop-outs or wastage. This is in sharp contrast to what occurs in the other agricultural training establishments and the reason for this is no doubt the fact that the college's curriculum is extremely specialised and, furthermore, those who leave the

college are not eligible for admission to other institutions of higher education. In view of this, one can no doubt assume that those admitted to the college are fully aware of these restrictions and are therefore much more highly motivated than those enrolling in other agricultural training establishments.

The Kuku Institute provides specialised training for middle-level technicians in animal, dairy and poultry production and the re-utilisation of animal by-products. The course lasts three years and the Institute has a permanent enrolment of some 60 students.

3. The Abu Haraz and Abu Naama Institutes

The building of the Abu Haraz and Abu Naama Institutes was begun in 1969 with financial assistance from the World Bank. The Abu Haraz Institute specialises in irrigated agriculture as practised in the Gezira Scheme whereas Abu Naama produces technicians for the Blue Nile province specialised in mechanised agriculture. Abu Haraz was opened in 1978 and Abu Naama in 1977/78.

Ninety-two students were enrolled for the first year and the initial staff of teachers and technical assistants is as follows: 4 teachers, 4 assistant teachers, 4 demonstrators - all Sudanese - and 4 technicians for the practical work - who are graduates of the Khartoum Polytechnic Institutes.

The curriculum was devised in close collaboration with experts from the World Bank. As far as the theoretical instruction is concerned, it is more or less the same as the Shambat Institute's curriculum but, in theory, the students will be given practical instruction of a very intensive kind or, at any rate, more intensive than that given by other institutes on the same level. It should be mentioned that the Rahad area, one of the largest in Sudan after the Gezira Scheme, will be extended in its second phase to include the Abu Haraz school. The location of this Institute was in fact part of the policy to create links between the centres of production and the centres of education. The recently recruited staff at Abu Haraz consider that the Institute will probably be more successful in performing its function than its predecessors have been. However, they are not unaware of the possibility that they may well have to face the same problems as the others, and they are convinced that most of their students will seek admission to a university.

Table 15. Enrolment in Forest Rangers Division of the College of Agriculture

Year	1st grade	2nd grade	Total enrolment
1972/73	-	18	18
1973/74	29	-	29
1974/75	-	28	28
1975/76	28	-	28

The intake for this college used to be for every two years; now it is for every three years, but it will become annual as soon as capacity is enlarged.

CHAPTER 8

AGRICULTURAL TRAINING AT UNIVERSITY LEVEL

1. The Faculty of Agriculture at Khartoum University

The Faculty is made up of nine departments: agricultural botany, agricultural engineering, animal production, biochemistry, soil science, crop protection, horticulture, rural economics and forestry.

Admission to the Faculty is by a selection operated amongst students who have done a preliminary year in the science or engineering faculties. The first of these groups will be expected to specialise in agriculture (B.Sc.). The course at the Faculty of Agriculture as such lasts four years, which, when added to the preparatory year in science or engineering, means a total of five years' study.

In 1978 the staff comprised 38 professors in situ and 23 professors who were undergoing further training abroad. There are a total of 24 tutors and assistants.

Average enrolment in the first year at the Faculty during the period 1972-78 was 230 students, the average number of students beginning their fourth year was 160 and the number graduating, 146. These figures indicate the considerable number of drop-outs (see Tables 16 and 17). The highest drop-out rate occurs, as with most faculties, between the first and second year, but it is still sizeable at the later stages.

In fact, the wastage rate would be a lot higher if the repeaters were included. A survey on the reasons for this wastage listed the following factors in order of importance:

- Faculty policy is to maintain a very high professional and academic standard and wastage is therefore high.
- Although the standard at Khartoum University's Faculty of Agriculture is fully satisfactory, this does not prevent certain foreign universities from attracting a number of Sudanese students.

However, there are several reasons for a small percentage (about 5 per cent) of the students admitted to the Faculty of Agriculture who opt to continue their university education whenever they find an opportunity to do so, abroad. This is not unique to agriculture, rather, it is a common practice in all other colleges whenever the first choice of a student is not fulfilled.

Cairo University as a case in point and admission to the Faculties of Medicine and Pharmacy is very much sought after. In this connection, it should be mentioned that medical and pharmaceutical degrees are generally the most highly prized, no doubt because they are passports to some of the most highly paid professions.

Table 16. Enrolment in Faculty of Agriculture - Khartoum University

Year	1st grade	2nd grade	3rd grade	4th grade	Total enrolment
1972/73	220	205	134	79	638
1973/74	207	200	205	124	736
1974/75	274	195	204	189	862
1975/76	215	221	205	174	815
1976/77	234	222	221	174	851
1977/78	225	177	187	204	793
1978/79	234	194	156	179	763

Source: Ministry of Agriculture.

Table 17. Those who drop out from the Faculty of Agriculture

Year of transfer	From 1st grade to 2nd grade	From 2nd grade to 3rd grade	From 3rd grade to 4th grade
1972/73	-	-	-
1973/74	- 20	0	- 10
1974/75	- 25	+ 4	- 16
1975/76	- 53	+ 10	- 30
1976/77	+ 7	0	- 31
1977/78	- 57	- 35	- 17
1978/79	- 31	- 21	- 8

Note: The table depends on the data in Table 16.

2. The Faculty of Veterinary Science at Khartoum

Admission to this Faculty is based on a selection operated amongst students who have done one year in the science faculty (biology section).

Average first-year enrolment over the period 1972/73 - 1978/79 was 103. Over the same period, average enrolment for the fourth and last year was 71 students, compared with 69 who received degrees. These figures, which are shown in Tables 18 and 19, indicate the high level of drop-outs. As always, the highest number of drop-outs occurs between the first and second year.

The basic problems facing the veterinary faculty are the same as those for the agricultural faculty, i.e. the reason generally given for this high wastage rate is the desire of the university authorities to maintain a very high academic standard. This is, in fact, evidenced by the considerable number of repeaters, particularly in the first year, e.g. in 1977/78 first-year repeaters numbered 15 and 1978/79 also 28. Here again, according to the university authorities, the drop-out rate can be explained by the number of students who wish to study abroad - in most cases, medicine and pharmacy.

Table 18. Enrolment in Faculty of Veterinary Science - Khartoum University

Year	1st grade	2nd grade	3rd grade	4th grade	Total enrolment
1972/73	103	99	42	41	285
1973/74	100	94	87	41	322
1974/75	104	102	85	82	373
1975/76	104	83	97	78	362
1976/77	100	94	77	84	355
1977/78	98	83	95	76	352
1978/79	113	61	67	95	336

Source: Statistics of Higher Education, Records of the Registration Office.

Table 19. Those who drop out in Faculty of Veterinary Science - Khartoum University

<u>Year of transfer</u>	<u>From 1st grade to 2nd grade</u>	<u>From 2nd grade to 3rd grade</u>	<u>From 3rd grade to 4th grade</u>
1972/73	-	-	-
1973/74	- 9	- 12	- 1
1974/75	+ 2	- 9	- 5
1975/76	- 21	- 4	- 7
1976/77	- 10	- 6	- 14
1977/78	- 17	+ 1	- 1
1978/79	- 37	- 16	0

Source: Statistics of Higher Education. Record of Registration Office.

3. The Juba and Gezira Faculties of Agriculture

The Faculty of Agriculture at Juba University, the first university to be set up in southern Sudan, has the task of training professionals specialising in the protection and balanced utilisation of natural resources. It was opened during the year 1977/78. It is a four-year course and in 1977/78, 95 students were enrolled but only 55 in 1978/79. This faculty is currently experiencing problems in recruiting teaching staff.

The Faculty of Agriculture at Gezira University is the most recent one opened and its first students, 65 in number, were admitted in November 1978. It is intended that this faculty, which is situated in the heart of the Gezira province, should train agronomists specialising in the type of agriculture practised on the irrigated areas in this province. At present, the teaching staff is made up of 16 professors. It is planned that the student should spend half of his time during his last two years of specialisation doing practical work on the land. The curriculum for this faculty was drawn up with the collaboration of Unesco and FAO experts. It should however be mentioned that no type of formal - nor even probably informal - co-operation has been envisaged with the Gezira Scheme authorities.

The foregoing analysis has enabled us to highlight the main problems affecting the system for training supervisors and technicians. Aside from the cultural and social aspects which do not encourage the better elements to enrol in the sector of agricultural education - irrespective of the level -

the most important factors limiting recruitment are the financial constraints. They are also the cause of the difficulty in integrating agricultural education with existing development projects and, at the same time they are one of the factors which encourage academic education to the detriment of practical education. The consequences of this will be made apparent when we compare the demand for supervisors and technicians with the supply.

PART IV - MATCHING THE SUPPLY AND DEMAND FOR AGRICULTURAL
TECHNICIANS AND SUPERVISORS IN QUANTITATIVE AND
QUALITATIVE TERMS

In this section, our intention is to analyse to what extent the supply of technicians and supervisors corresponds to the country's requirements in both quantitative and qualitative terms. This is no easy task, particularly with regard to the quantitative aspect, if one is to go beyond the global forecasts and penetrate beneath the surface.

In fact, we discover not only that the agricultural training establishments are not capable of supplying the technicians and supervisors required for the modernisation and expansion of Sudanese agriculture, but also that the current socio-economic situation in Sudan makes optimum utilisation of such technicians and supervisors very difficult.

There is, for instance, a substantial exodus of trained staff who simply abandon farming; there are also losses in levels of skill which distort all the statistics. To get some idea of the real availability of technicians and supervisors, one needs to take the analysis beyond the figures for apparent availability, i.e. make allowance for losses in staff and levels of skill prior to employment. One then has to examine the problems involved in utilising these technicians and supervisors in the field. Despite the difficulty in obtaining really reliable estimates, the research team's findings nevertheless reveal with sufficient clarity the nature of the problems which need to be solved in order to redress the situation.

CHAPTER 9
MATCHING SUPPLY AND DEMAND:
THE QUANTITATIVE ASPECT

1. Problems in planning the supply

The forecasts for the supply of technicians and supervisors, as well as the analysis of requirements, were made by the ad hoc interministerial committee set up to participate in the preparation of the Vith Plan.

The work of forecasting carried out by this committee was, without doubt, largely responsible for drawing attention to the problems of skilled labour in Sudan. However, it must be said that one can have few illusions about the practical value of these forecasts. Aside from the question of the availability and reliability of basic data on which to base such forecasts, the "crudeness" of the results makes it impossible to give a precise orientation to the training programme for these future technicians and supervisors - a point already made in connection with the analysis of requirements. It would appear that this situation is aggravated by the lack of co-ordination between educational planning bodies and the future employers of trained staff. The supply of specialised staff is planned separately from requirements and on the basis of data which there is no official means of comparing.

2. The difficulties in co-ordinating planning activities

The main reason for the absence and at the same time for the urgent need of co-ordination of planning activities stems from the widespread dispersion of both the demand and the supply. With regard to the supply, for example, the four Higher Institutes of Agriculture are under the authority of the Institute of Technology, whereas the Ministry of Education is directly responsible for the senior secondary agricultural schools. The Faculties of Agriculture and Veterinary Science have their own separate administrative bodies.

On the employers' side, there are the different corporations directly responsible for operational projects plus the various ministerial departments which have decentralized units operating in the field. Each of these units needs specialised staff, middle-level technicians and skilled workers specially trained for the type of work being carried out. However, there is no official machinery for comparing the requirements of these units with the supply provided by the system of education. It is true that a Senior

Committee for Education has been set up to co-ordinate the supply of education with national requirements, but this Committee, by virtue of its wide-ranging brief deals with the problem in far too broad a manner and does not devote special attention to the problems of the supply and demand for technical staff in the agricultural sector.

In the view of most of those responsible for technical education - from the head of the Faculty of Agriculture at Khartoum University to the head of the senior secondary agricultural school at Talha - there is an urgent need to set up a special permanent committee whose task it would be to harmonise agricultural education policy with the requirements of the Ministry of Agriculture and other employers of agricultural students¹.

Because of the current lack of co-ordination, it is not possible either to define the content of curricula in relation to actual needs, or to assign a clear and specific function to each type of specialised agricultural training establishment, or to draw up a precise plan for the number of technicians and supervisors to be trained - with the result that, in addition to the inadequacy of the supply in terms of numbers, there are also deficiencies of a qualitative nature.

3. The inadequacy of the supply in quantitative terms

Despite the fact that the forecasts for the supply lack detail, the figures do however give a pretty clear indication of the size of the deficit compared with requirements. As Table 20 shows, this deficit amounts to at least 50 per cent for all levels and is as much as two-thirds in case of skilled workers. The pattern of supply is in fact a reverse image of the requirements, i.e. whereas the country is capable of producing a relatively large number of university graduates specialised in agriculture and stock-breeding, it cannot manage to produce those middle-level technicians whose rôle is essential to the achievement of technological progress.

¹ In August, 1980, five new permanent councils began their work in the National Council for Higher Education, their main function being co-ordinating and laying down guidelines for the educational policies of different disciplines in education. The Council for Natural Resources and Scientific studies is one of these five. The membership of the council comprises employers, university professors, representatives of Khartoum Polytechnic and other schools and colleges.

Fig. 2
Ministry of Agriculture
Organizational Structure

Pezra Scheme	Minister of Agriculture	Public Cooperation for Agricultural Sector
Rahad Scheme	State Minister for Veterinary	Public Cooperation for Animal Protection
Legal & Security Affairs	State Minister for Natural Resources	Cooperation of Agricultural Resources

Natural Resources Undersecretary	Senior Undersecretary	Agricultural Services Undersecretary	Veterinary Undersecretary
Forest Administration	Planning	Provincial Affairs	1) Animal health
Soil Maintenance Unit	Administrative & Financial Affairs	Crops Protection	2) Animal Production Res. Unit
Wild Animals Unit	Engineering Affairs	Horticulture	3) Veterinary Research
	Foreign Affairs	Agriculture	
		Seed Reproduction	
		Soil Research	

Table 20. Forecast demand and supply of skilled workers for the
Plan 1977-82

	<u>Demand</u>	<u>Supply</u>	<u>Deficit</u>
Agriculturists	5,000	2,660	2,340
Veterinary Doctors	2,200	1,000	1,200
Agriculture and Forestry Technicians	5,000	2,150	2,850
Veterinary Technicians	2,000	580	1,420
Skilled Labourers (Agriculture and Veterinary)	15,000	4,000	11,000
Total	29,200	10,390	18,810

Source: Ministry of Planning - (as for Table 5).

CHAPTER 10

THE OUTFLOW AND LOSS OF STAFF

In the Sudan there are various anomalies which encourage an exodus of trained staff and cause a considerable loss of personnel and this not only greatly distorts planning calculations but substantially reduces the strength of the agricultural services, although it is not always easy to put precise figures on this.

1. The loss of middle-level staff and technicians once they leave the agricultural institutes

The system of technical education is such as to provide a multiplicity of paths between the various levels. For example, students leaving the institutes of agriculture and even the secondary agricultural technical schools can legitimately and without great difficulty enter a university. Wherever there are administrative, legal or educational obstacles to this, these middle-level technicians always have the alternative of continuing their studies in Egyptian universities where conditions of admission seem to be particularly easy to fulfill. At first sight, there would not appear to be any great harm in this. It might even be said that impossibility of access to a university from the technical stream is a frequent source of grievance in many countries of the world. But where there is too great a difference between the work status of university-trained staff and those from an institute of technology, this state of affairs encourages a "drift" of middle-level staff towards university training, thereby disrupting the whole planning process.

In Sudan, these classic "drift" processes are of two kinds:

- The entrance examinations to the university faculties, in particular the Faculty of Agriculture at Khartoum can be said to discourage a good number of candidates. They therefore enrol in the institutes of technology (Shambat in particular) or in the senior secondary technical schools.
- When they finish, vast numbers of them apply for university entry. A substantial proportion of the students entering the Faculty of Agriculture at Khartoum University come from the institutes and even from senior technical secondary schools.

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Despite the efforts of senior university authorities to put a stop to this "side-door" entry of technicians into higher education, social pressure is such that it is hardly possible, given the present structure of

the education system to take really effective measures to prevent this. The intention of the Dean of the Faculty of Agriculture at Khartoum is to reduce the number of students admitted to the Faculty from the institutes by at least 10 per cent, but it is fairly doubtful whether he will be successful. Although it is extremely difficult to put a figure on this (since there is no reference to it in the statistics) surveys amongst officials at the agricultural institutes have shown that the numbers involved are fairly substantial. For example, the Director of Planning at the Ministry of Education stated that all of the students who graduated in 1977 from the New Halfa Senior Secondary Agricultural School went on to higher education. Between 40 and 50 per cent of students finishing their studies at the Shambat Institute of Agriculture do not start a job but enrol for a course of higher education. Ninety per cent of the students at the Gezira Faculty have come from the Talha School of Agriculture, etc. What is more, the pressure applied to restrict the flow from higher technical to university education, has resulted in a good number of students enrolling in agricultural faculties at Egyptian universities. On their return from Egypt - providing they return and do not take up permanent residence abroad - these students, with their university degrees, automatically join the category of senior staff.

Such transfers from the technical levels to the university levels would not be serious if Sudanese agriculture were effectively short of staff at all levels. However, these transfers distort the pattern of supply and invalidate planning assumptions. If for example plans and forecast availabilities in terms of middle-level technical staff are based on data concerning the "production capacity" of the institutes of agriculture and the senior secondary agricultural schools, there is every reason to believe they will be wrong. The output of these institutes and senior secondary technical schools will not in fact represent the available supply so long as these "losses and outflows" towards higher education continue to gather momentum. One needs to emphasise the particular gravity of this situation since it involves the type of supervisors and technicians who are most sorely lacking, as was revealed in the forecasts made in preparation for the VIth Agricultural Plan.

There is another particularly serious form of staff loss which occurs when those in service are sent for further training.

2. Losses through in-service training

In view of the lack of specialised training facilities, it would seem logical to send staff and technicians abroad for further training. However, sending large numbers of Sudanese to other countries is not without its risks in view of the current legal and social situation in Sudan.

Students, particularly those who have not yet qualified, normally have to spend some time abroad and, in fact, they usually try to prolong their period of education or training. On their return, it is not unusual to find that their attitude to life has changed - they find it difficult to readjust to the conditions of their former rural existence. On every development project for irrigation, mechanisation or improving farming techniques in areas farmed in a traditional manner, it has become a generally accepted fact that technicians sent abroad for training are very reluctant to resume their former work. They try to get a job with international organisations, in the private sector or in the semi-public sector of the corporations.

Obviously, questions of pay and working conditions have a lot to do with their reaction. When they return to their previous ministries, they generally refuse to go back to their former jobs on the land which seriously disrupts the planning of staff assignments. Around the major towns or main centres there are generally enough specialised technicians and supervisors but, as soon as one gets away from these urban areas, one finds considerable instability amongst the staff and, more important, substantial "gaps".

Similar tendencies can be observed in other developing countries. In the absence of adequate political and social motivation, the solution most widely adopted and, no doubt, the most effective is to establish a differential pay scale based on the conditions prevailing in the different regions and sectors of activity.

It is strange that nowadays there is no effective legal stipulation or regulation of a contractual or binding character which would enable the state to avoid losing the benefit from its investment in such training. As we shall see, this not only applies in the case of staff who have received their training within the country but also to those who have been trained abroad. In view of this, it is scarcely surprising that the real cost of a trained technician actually working in the exact place where his skills are required is very high. To a large extent this is the result of the defections and the pressures brought to bear to obtain a more favourable posting.

A similar type of loss occurs with trained staff who for the most part, have already received further training and who emigrate abroad.

3. Loss of technical and supervisory staff through emigration

In theory, the employment of Sudanese technicians abroad is subject to approval by the Department of Foreign Employment at the Ministry of Public Service in accordance with bilateral agreements concluded with most of the Arab countries for the exchange of workers. Although restrictive, these agreements in practice have not prevented a fairly substantial number of Sudanese technicians and supervisors from emigrating officially or unofficially every year.

According to official figures from the Ministry of Public Service, between July 1974 and June 1975, 829 technicians and supervisors left the country; between July 1975 and June 1976, the number was 2,495 and, for the last period for which figures are available, i.e. July 1976 to March 1977, the number of those emigrating was 1,318.

This would seem to be a very substantial loss, particularly when one considers the number of unofficial emigrants, although there are no precise figures available on this. There is no doubt that this trend is still continuing today. In this connection, the head of the Planning Department at the Ministry of Education stated that all of those graduating last year from the Al Fasher Business School emigrated en bloc to Libya. This same country had just requested (November 1978) official permission to "import" 700 Sudanese technicians and supervisors in 1979 - this request was officially refused but it is not certain that the real number will not be in excess of this.

Engineers and graduates emigrate in the main to the Arab oil states where salaries are extremely high, even compared with the top salaries paid in Sudan. A qualified Sudanese technician employed in Saudi Arabia, Libya or in one of the Gulf Emirates will earn at least four times what he would for a similar job in his own country. In 1976, Saudi Arabia absorbed 1,022 technicians of all types, the remainder being divided between Kuwait, Libya, the United Arab Emirates, Qatar and Abu Dhabi.

It has not been possible to get a breakdown of these emigrants by specialisation but, according to the Ministry of Public Service, the agricultural specialists who emigrate are for the most part agronomists and graduates from the institutes of agriculture.

There can be no doubt that a skill drain of these dimensions is a major factor contributing to the shortage of agricultural staff. Nor can there be any doubt that at the moment no effective means exist for reducing this outflow, unless more coercive measures are introduced. Since a massive increase in wage levels is out of the question in Sudan and, since it would be practically impossible to control the emigration of technicians by means of agreements with the countries concerned, it has been suggested that the regulations concerning individuals who leave the country without authorisation should be tightened up and that ~~there~~ should be a stricter control of emigration through the system of issuing passports.

CHAPTER 11
THE GOVERNMENT DEPARTMENTS' PLACEMENT PROCESS
FOR TECHNICIANS AND SUPERVISORS

In theory, the process of allocating staff should involve a series of decisions taking into account the needs of the Ministry of Agriculture and the large corporations, based on the policy of agricultural development and modernisation and the type of staff available. In practice, such co-ordination would seem difficult to achieve.

1. University post-graduates

A decree setting out conditions of employment in the public service for graduates and post-graduates, including those with degrees in agriculture, was published in May 1975. Its provisions were as follows:

- The starting salary for staff at this level would range between £S400 - £S650 per year based on a scale of qualifications and the next salary level would be reached after three years, where the range would be between £S690 - £S1,055 p.a.

- After a further three years, the salary would be increased once again to between £S1,100 and £S1,335 p.a. The next increase would occur five years later to a salary level of between £S1,850 - £S2,000 p.a.

- The final grade would be attained after a further five years. In theory, promotion to a higher grade is dependent not only on seniority but also on the evaluations made by the person's immediate superiors. For those with a B.Sc. degree the salary scale is the same except that they reach the last grade after eighteen years of service compared with sixteen in the case of post-graduates.

Anyone with a B.Sc. degree applying for a government post will automatically be hired - at the moment, no account is taken of the vacancies available as in the case of arts graduates. This obligation to provide every science graduate with a job has no real negative effect at the moment because of the shortage of trained staff but nevertheless, in certain sectors, one is beginning to see signs of a "bureaucratic overload".

The first step in the employment procedure for graduates is to register with the "Public Service Selection Committee" at the Ministry of Public Service which has sole responsibility for employment throughout the entire public service. The Committee then sends lists of these graduates classified in accordance with their qualifications and preferences to the various ministries

and corporations. Generally speaking, candidates express a preference for the corporations because they pay higher salaries. The ministries then allocate these graduates to the various sections theoretically on the basis of requirements.

However, in practice, this system produces a form of imbalance. Since most candidates want to work in a corporation rather than in a ministry, preference is usually given to school-leavers and university graduates with the best results. Thus the top students are creamed off by the corporations whilst the rest are automatically allocated amongst the ministries. This system affects the Ministry of Agriculture in the same way as it does the other ministries.

Although it is extremely difficult to get precise details on the extent of this and its effects, there can be no doubt that the substantial pay differentials between government departments and the semi-public sector of the corporations are a cause of qualitative imbalances in the distribution of senior administrative and technical staff which are bound to affect the quality of management. These imbalances have become even more marked with the development of the private sector and, in particular, with the emergence of large agricultural or agro-food companies in recent years.

Salaries in the private sector are anything from 40 per cent to 100 per cent higher than those in the public or semi-public sector. It is not therefore surprising that the private sector attracts the best candidates, although the number of vacancies is limited. And lastly, as was mentioned earlier, jobs abroad, particularly in the Arab Gulf States, carry salaries which are so attractive that many technicians have no hesitation in emigrating. This qualitative ranking of jobs, ranging from employment abroad, followed by the semi-public and private sectors and ending with the government departments, seems to correspond pretty closely to the classification of staff in terms of quality.

This problem, which could well have very serious repercussions, is a subject which merits separate and detailed study.

The obligation to hire imposed upon ministries creates another problem of a general kind which affects the overall quality of the services they provide - although, here again, it is difficult to measure its exact impact. Since, by law, ministries have no alternative but to hire these graduates, they are sometimes obliged not only to assign them to posts against their wishes - which is less serious - but often contrary to the specific requirements

of the various sections which then find themselves saddled with graduates for whom a job has to be found. Thus, depending on the type of qualification, some sections are short of the type of staff they require whereas others have a surplus.

What is more, these surpluses are related not to the country's aggregate needs, but to the availability of other factors involved in the management of agriculture, e.g. the shortage of transport, accommodation in the provinces, laboratories for analysis or research, etc. The usual solution for such problems, where staff are not used for the type of work for which they have been trained, is to transfer them to other sections for which they are not really qualified.

Although senior agricultural staff are to a certain degree "polyvalent", it does not seem normal that veterinarians for example should be assigned to phytosanitary departments or specialists in the agro-food industry to cotton farming. In addition, this over-staffing or "miss-staffing" creates an undercurrent of dissatisfaction which certainly has an adverse effect on the smoothness and continuity of the everyday management of agriculture, particularly because of the considerable instability it creates amongst staff. In fact, in the Ministry of Agriculture the number of requests for transfers would seem to be abnormally high.

2. Technicians from the Agricultural Institutes

The regulations and conditions governing the employment of middle-level technicians in the public service were set out in a decree published in April 1978. In the case of agriculture, this applies to students trained at the Agricultural Institutes at Shambat, Abu Naama, Abu Haraz and Soba. Although their salary scale does not differ greatly from that for university graduates, particularly at the start of their career, the rate of promotion is very different.

The starting salary for a technician at this level ranges between £8400 and £8600 per annum. After five years, it increases to £8695 - 1,055 p.a. After four years it rises to £81,100 - 1,335 and, after a further four years, to £81,500 - 1,650. Promotion to the next grade occurs three years later. The salary range for this fifth grade is between £81,700 - 1,850, and then, after a further four years the technician reaches the highest grade where his salary will be between £81,850 to £82,000 p.a. Subsequently, promotion depends on the vacancies available and is not governed by this decree.

This decree in fact is the result of political pressure brought to bear by this category of staff who, for many years, had felt that their position compared unfavourably with that of university graduates. In the agricultural sector for instance, they argued that they had all the practical responsibility for development projects with none of the advantages enjoyed by graduates who, for the most part, had administrative posts. The increasing number of middle-level staff leaving agriculture forced the government to revise their pay scales and the system of promotion. Those who are coming out of the agricultural institutes today seem to be relatively satisfied with the provisions of this recently published decree.

However, it has not pleased the specialists and technicians with university degrees since they feel that this amounts in practice to creating a parity between the pay and benefits of university graduates and those of technicians from the agricultural institutes. Since there is a fairly plentiful supply of jobs outside the public sector, there is every reason to think that this state of affairs will not make it easier for the state to recruit staff and that considerable pressure will be brought to bear to change the status of university graduates.

It would now seem that the question of revising the status of junior technicians trained at the senior secondary agricultural schools is destined soon to become as burning an issue as the revision of the status of technicians from the agricultural institutes, which has just been settled. If this revision is not carried out, there is every likelihood that enrolment in these schools will suffer in both quantitative and qualitative terms, which would further accentuate the already substantial imbalance between the supply of middle-level and junior technicians and the supply of senior staff.

CHAPTER 12

THE PROBLEMS OF SPECIALISATION

In an attempt to increase the level of competence of the staff employed in agriculture and to adapt their real knowledge to the real problems with which they are confronted in other words, to remedy the shortcomings of the curricula - the Ministry of Agriculture has set up a training administration, one of whose tasks is to train staff who have had no form of technical agricultural training. Policy for this administration is decided by a Senior Training Committee at the Ministry made up of representatives from all its departments. The training is provided by agricultural training establishments in Sudan and abroad.

1. The numbers involved in this training

Roughly 40 per cent of all the graduates technicians and middle-level staff under the Ministry of Agriculture's authority have been given specialised training of one sort or another. For example, in the case of the Department of Agriculture, which has a fairly privileged position in this case, the figure is as high as 50 per cent. However, there are very wide disparities depending on the sector of activity (cf. Table 21), e.g. in the seed improvement section, none of the staff have been given special training; on the other hand, a vast majority of the staff and technicians in the soil survey section have been given special additional training for their assigned tasks.

Considerable efforts are, however, being made to increase the number of those given special additional training. For example, in 1975-76, the Training Department recommended training courses for 275 members of the Ministry of Agriculture's staff chosen on the basis of a list of priorities drawn up by the Senior Committee for Training. In 1977-78, training courses were approved for a total of 436 supervisors and technicians on the Ministry's staff. Of these, 210 were scheduled for training in Sudan and 216 were designated for special training abroad. Table 22 shows the breakdown by administration and field of study of the technical and supervisory staff given special training during 1977.

The considerable efforts made to provide specialised training should in theory raise the qualifications of existing staff as well as those recruited during the Vth Plan to an adequate level, although, as we have seen, their numbers will still be insufficient. However, in the view of those responsible

TABLE 21
AGRICULTURAL SERVICES DEPARTMENT

STAFF

Section	Post Graduate	University Graduate	Agr. Instit.	Senior Second.	Non-Trained	Trained
Plant protection	23	37	18	22	78	158
Soil survey	14	36	20	5	75	300
Provincial affairs		52	20	8		
Agricultural extension	7	55	18	28	77	57
Horticulture	12	71	20		103	50
Seed improvement	9	42	71		122	
Substation	36	118	47	54	255	399

Source : Ministry of Agriculture, Agricultural Service Department

for training at the Ministry of Agriculture and the Ministry of Planning this will depend on whether solutions are found for the administrative and social problems, some of which would appear to be serious.

2. Organising the training

The basic problem is that of finance. In fact, because of budget limitations, it will not be possible to train all the existing staff and still less all of those recruited during the VIth Plan. But training is by no means the only aspect affected by budget restrictions - these affect all the programmed expenditures of the Ministry of Agriculture as well as those of other Ministries. In other words, Sudan's development plans can be said to be generally too ambitious in relation to the country's assured resources. Training, of course, is no exception to this.

Cost-benefit analyses of training seem to indicate that it is preferable to provide specialised training for technicians and staff within the country rather than abroad. It would seem that the ideal solution would be to set up training programmes within the country and enlist the aid of technical staff from abroad. The main problem

TABLE 22
BREAKDOWN OF TECHNICAL AND SUPERVISORY STAFF
GIVEN SPECIAL TRAINING IN 1977

Administration	Approved Training	Field of Study		
		Field	Internally	Externally
Plant protection	13	3 MSc. 10 training	10	3
Direction of animal resources	18	16 MSc. & Ph.D 2 training	2	16
Agr. Extension	5	5 MSc.		5
Engineering affairs	5	3 MSc. 1 fellowship 1 training		5
Wild life	4	3 MSc. 1 training		4
Foreign relations	1	1 MSc.		1
Animal economics animal resources	1	training		1
Agr. economics	5	5 MSc.		1
Seed preparation	4	4 MSc.		4
Pasture & range management	5	5 training		5
Planning	4	3 MSc. 1 Ph.D.		4
Agr. research cooperations	38	17 MSc. & PhD 12 PhD 1 Diploma 2 MSc. 6 training		38
Public cooperation	14	9 MSc. 1 diploma 3 training 1 fellow	3	11

Administration	Approved Training	Field Study		
		Field	Internally	Externally
Gezira scheme	185	14 MSc. PhD 12 diploma 159 training	119	66
Horticulture	9	7 MSc 2 training	1	8
Forest	9	6 diploma 3 MSc.		9
Training & Adm.	2	1 MSc. 1 training	1	1
Soil conservation	13	4 MSc. 3 diploma 6 training	7	6
Rural water development cooperation	24	2 MSc. 6 diploma 16 training	7	17
Mechanized Farming	74	3 MSc. 6 diploma 65 training	62	12

Source: Ministry of Agriculture, Training Administration

with this method is to find foreign instructors and technicians who would be willing to spend long enough time in Sudan to provide adequate instruction in their speciality. This is due not only to the lack of candidates but also to the cost of these operations and the problems of the available physical and administrative facilities.

In Sudan, staff who have received no specialised agricultural training are generally given in-service training in specialised centres like the one at Tozi (a training centre for junior technicians - tractor drivers and mechanics) and in the faculties of agriculture and the agricultural institutes in the case of those who already have some form of agricultural training. Each year, the faculties and institutes are obliged to provide training for a certain number of ministry officials. In addition to this, as already mentioned, a number of already trained staff are employed abroad.

It is widely agreed that these foreign faculties, institutes and universities tend to provide a type of training which is so sophisticated and sometimes so theoretical as to be well beyond the standard of Sudanese agriculture and consequently of little practical value. On the other hand, as far as the training in Sudan is concerned, its quality is no better than that of the formal training courses due to the uncertainty, unspecific curricula, and the lack of communication between the training centres and the production centres which employ the staff.

What is more, since such training can have an effect, even if only a limited one, on the individual's salary level, the demand for it is enormous and this can result in training which has no connection with the real needs of agricultural services. If there is a need for soil experts, for example, it is difficult to find national or international facilities for training them, this does not prevent technicians, whom one would like to see becoming soil experts, being sent for specialised training in a more or less unrelated area. Which is bound up with the fact that training is, to a large extent, regarded by the government departments and, above all, by their staff as a right insofar as it is a means of improving their status. This makes for a system of training whose effectiveness is questionable and whose productivity is probably not very high. In any case, these aspects of the problem warrant in-depth study.

It is certain that the shortcomings of this training programme have a very great effect on the level of practical technical knowledge which can be communicated and applied in the field. However, it must be said that this is not the only factor responsible for the low productivity of Sudanese agriculture nor for the slowness of technological progress in this sector of the economy.

CHAPTER 13

TECHNOLOGICAL PROGRESS AND THE AGRICULTURAL SERVICES: PROBLEMS AT THE OPERATIONAL LEVEL

The disparities and differences between the requirements for supervisors and technicians on the one hand and, on the other hand, the type and number of agricultural specialists supplied by the education system affect conditions and operations in the field in a variety of ways. In particular, it is easy to appreciate the magnitude of the problems caused by the lack of middle-level and junior technicians and the adverse effect this has on the spread of technological progress in the agricultural sector.

1. Deficiencies in the field services: the plant protection department

The Agricultural Services Department is one of the most important operational departments within the Ministry of Agriculture. This administration is made up of six departments which have field staff working in a number of provincial and local stations and sub-stations.

The plant protection department is the largest of these and, at the same time, the most important one in view of the seriousness of the problem of plant disease and pest control in Sudan. This department has 22 major stations spread throughout the country's 15 provinces and 40 sub-stations. Each of these units is responsible for monitoring the spread of plant disease and taking remedial action, whether this be in the major irrigated areas, the mechanised farms, the private sector or in the traditional farming areas.

One thing is immediately obvious: despite the large number of staff employed on this task, there is a glaring shortage of field technicians whereas there is a seemingly disproportionate number of senior staff. Whenever this happens, the specialist technicians are replaced by school-leavers from the general education cycle who are given a somewhat summary training in the field.

For instance, the staff at this department's administrative headquarters comprises 19 persons with university degrees, including 12 with post-graduate degrees, 3 from the Shambat Institute and 2 from an agricultural school. The small number of junior technicians has been bolstered by the addition of 44 former students from the general secondary cycle for whom it is attempted to provide some form of practical training in the field. In the

station for the province of Khartoum, there are two agricultural faculty graduates and 16 "technicians" from the general secondary cycle; in the Blue Nile province the staff comprises 9 university graduates, 3 from the agricultural institutes, 3 from agricultural schools, plus 42 "technicians" from the general secondary cycle with no formal agricultural training. At the Gezira station, the chemistry laboratory's staff is made up of 12 graduates 8 from the agricultural institutes, only one technician from an agricultural school, and 50 "pseudo-technicians" from general secondary schools.

The situation is the same throughout all of the 22 stations and sub-stations, as the aggregate figures show:

University graduates and post-graduates:	148
Former agricultural institute students:	47
Former agricultural school students:	47
"Technicians" with no formal specialised training:	273

It is very obvious that the breakdown between senior staff and junior staff is very far from the required norm and that the number of junior field technicians has had to be made up by hiring staff with no qualifications.

In these conditions, it is no wonder that the sector's efficiency is low. The director of this department in fact stated that, if phytosanitary measures were to be effective, it was absolutely essential that plant diseases should be identified rapidly and accurately. However, at present there is insufficient trained staff to do this. The system of disease control is therefore not very effective and this is compounded by the high cost of treatment per unit of land and, above all per volume of production after attacks from disease.

What is more, this goes a long way to explaining why the productivity of Sudanese agriculture is substantially below world standards, a fact acknowledged even by local officials.

2. The agricultural extension department

Similar problems exist in other sectors where it is admitted that productivity could be improved through better technical supervision. This applies, for example, to phytosanitary control in the horticultural sector where expansion has become the key-note, to the control and improvement of seed and cereals, and to controlling the water hyacinth. These problems have become so serious that the VIth Plan provides for special funds to be made available so that technicians (irrespective of whether they have a formal agricultural training or not) can be given special training in these areas.

The other agricultural services departments suffer from the same problems, aggravated however by a lack of funds which means that they lack sufficient technicians and supervisors to cover the country adequately. The Agricultural Extension Service is the most glaring example of this.

The function of extension workers is to provide farmers with advice both of a technical kind (e.g. sowing times, utilisation of fertilizer, pesticides, planting distances, etc., ploughing times and depths, etc.) as well as of an economic and social kind (e.g. home science, etc.) - the underlying purpose being to increase the family income and welfare of farmers. It is obvious that the function of an extension service can have a great influence on the spread of technological progress. Unfortunately, it is impossible to perform this function satisfactorily with the existing number of supervisors and technicians.

The service, in fact, comprises 62 persons with university degrees including 7 with post-graduates degrees, 18 from the agricultural institutes, 28 from agricultural secondary schools and 57 from general schools who had been given special training in the field. Aside from the disproportionate number of senior staff compared with the number of field workers, in a sector which is primarily engaged in work at this level, the total number of staff is obviously grossly inadequate - taking the total staff figure, this works out at an average of about 10 extension workers per province (in fact, certain provinces have none at all since there are only 10 extension service staff).

In the case of seed improvement and multiplication and soil analysis, the problems are of a similar magnitude and nature. Their effect upon productivity is, in all likelihood, similar to that in the case of the plant protection service.

In fact, there is no doubt that this shortage of field agents and their shortcomings from a professional standpoint, coupled with the lack of funds and capital investment, are a decisive and direct cause of the low productivity of Sudan's agriculture. Sudan itself is not unaware of this fact and there is increasing support for the idea that expansion of the farming area needs to be planned jointly with an increase in the number of specialised technical and supervisory staff. It is also becoming increasingly apparent that such planning cannot restrict itself to forecasts, however sophisticated these might be - it is important that these should be accompanied by concrete social and economic measures which would enable the plan to rise above the level of mere wishful thinking based on what would be desirable to one of realism based on what is socially and economically possible.

CONCLUSIONS

The foregoing study is no more than a partial analysis of the relationships between education and technological progress in Sudanese agriculture. To a certain extent it deals with only one of the conditions for change, i.e. the training of agricultural technicians and supervisors in sufficient quantity and of sufficient quality and their rational utilisation. Aside from these initial and essential vectors of progress, a comprehensive study would need to take into account the impact of agricultural education on the actual producers themselves and also the possible effects of general education on the attitudes and outlook of the people involved, or whom one would like to see involved, in the process of agricultural improvement.

These two topics could be the subject for subsequent research projects.

Not only is this present analysis a partial one but, because of its global character, it leaves many questions unanswered. It could hardly have been otherwise considering the magnitude of Sudan's problem, the diversity of the situations and the difficulties in obtaining information. However, despite its limitations, it would seem that this analysis has helped to clear the ground and situate the major problems affecting the recruitment, training and utilisation of agricultural technicians and supervisors. It has also helped to highlight those problems which call for special study.

In our view, the most important of these problems can be summarised as follows:

1. Without doubt, one of the major factors retarding the spread of technological progress in Sudan's agriculture is the complete lack of agricultural and stockbreeding technicians and supervisors and, still more, the disproportion between the categories of skill. For instance, the shortage of junior staff, who are the essential link in transmitting practical knowledge to farmers, is a direct cause of the low productivity and one of the most immediate and obvious obstacles to the planned development of agricultural production. Naturally, other factors such as the lack of capital assets and the shortage of working capital also act as a brake on agricultural expansion. But, an increase in the numbers and an improvement in the quality of the field supervisory staff would no doubt increase the efficiency of Sudanese agriculture by ensuring that existing assets were put to better use.
2. Investigation carried out at the level of the actual projects show that these deficiencies are not only of a quantitative kind but also qualitative,

i.e. the technicians and supervisors when they leave school have no clear-cut specialisation; it would seem that their knowledge is too academic and often ill-adapted to local conditions, and, on the whole, they seem to have had too little practical training.

3. This state of affairs is partly due to the fact that the supply of technicians and supervisors is not properly planned in relation to requirements measured on a scientific basis. The planning of the supply of technicians and supervisors in relation to requirements is a very recent innovation - however, the forecasts made in connection with the preparation of the Vth Plan are still too rough. The requirements are determined on the basis of aggregate norms and not on the basis of a specific analysis of the actual agricultural development plans and their precise requirements, particularly in view of proposed technological changes. Generally speaking, the planning of requirements and the planning of supply are done separately, unless one considers as a form of joint planning the activities of the temporary ad hoc committee which compares total requirements with the total available supply at the time when the plan is being prepared. In actual practice, the requirements are expressed in an imprecise manner on the labour market whereas the supply is planned on the basis of criteria other than the requirements, e.g. the availability of funds for construction schools, paying teachers' salaries etc. The result is that the supply generally bears little or no relation to the demand. Certain categories of technicians are unable to find jobs - or at least ones which suit them - whereas other categories are sadly lacking.

4. The social, cultural and economic factors which put a higher value on academic as opposed to technical education, on certain types of university studies as opposed to agricultural and veterinary studies and on office work rather than farm work, are the cause of considerable distortions in the supply of technicians and supervisors for agriculture. It is all the more easy for such distortions to occur since the state has relatively little say in the way the training of technicians and supervisors is organised and especially since it is fairly easy to transfer from one educational level to another.

In these conditions, the natural trends can operate without hindrance and, whereas it may be possible to obtain senior staff for administrative and management posts, it is very difficult to provide and retain field technicians and supervisors. The measures required to reverse these trends

are naturally highly complex and it would take time to put them into effect. More than anything, this implies a genuine political desire to take such action.

The plans for providing a supply of technicians and supervisors drawn up by the educational establishments themselves - although unrelated to any concrete analysis of requirements - are generally never achieved. It is obvious that Sudan has made a considerable effort to develop technical agricultural education and even to "ruralise" the education in non-technical schools - as evidenced by the introduction of courses on agriculture in the curricula of primary and general secondary schools in rural areas.

The authorities concerned have no doubt realised that technical schools ought to satisfy the country's needs in terms of agricultural development. For example, an attempt has been made, on the one hand, to adapt the curricula of agricultural and veterinary science schools to suit these requirements and, on the other hand, to decentralise technical education and locate agricultural schools in those rural areas which are liable to use the students they train. However, such efforts have only been made recently and it will be a long time before their effects are felt. What is more, they are partially nullified by the difficulty of really integrating agricultural education and agricultural development projects. Thus, the new technical schools and faculties exist alongside the development plans and agricultural projects rather than being an integral part of them. This is true both from the administrative as well as the practical point of view, e.g. new schools and faculties have been created in the Gezira but, it would seem, had nothing to do with the Gezira project itself.

But what is more, although the number of agricultural schools and institutes and faculties of agriculture and veterinary science has considerably increased in recent years, these new additions fall far short of what was hoped for and planned. This "construction shortfall" is apparently due to the lack of funds, which itself is related among other things to the very sharp rise in building costs in Sudan and also no doubt to the organisational inability to undertake development projects of the magnitude of those planned.

6. The effects of this "construction shortfall" are of course considerable and obviously have repercussions on the total supply of technicians and supervisors - to a certain extent they are responsible for the shortage of technicians and supervisors revealed in the Ministry of Planning's forecasts. Thus, what is a serious shortage today will become even more acute if the

proposals for increasing agricultural production contained in the VIth Plan are put into effect - despite the fact that the agricultural faculties, institutes and schools are turning out trained students in increasing numbers. This shortage of technical staff, at least at the junior level, may very well prove to be an insurmountable obstacle to the achievement of these projects - even without allowing for the loss of students once they have completed their training in an agricultural school or institute.

In fact, for complex social, economic and cultural reasons, Sudan is faced with a very serious "brain drain" problem and the substantial outflow of technicians to foreign countries makes even more acute the qualitative and quantitative shortage of staff. The solution to this problem is bound up with a number of complex economic, political and administrative factors, which would have to be taken into account although they are well outside the limited field of education as such.

It would seem therefore that shortage of staff is currently a factor which is hindering technological progress and the development of Sudan's agriculture. Aside from the overall shortage, its most serious aspect is without doubt the quantitative and qualitative deficit of junior technicians and supervisors. Although there are other problems which require in-depth study, this one in particular would appear to warrant an urgent and specific study - one which would deal with the rôle of these technicians in agricultural progress, the way the supply of the different categories of staff is organised, their conditions of employment and the way they are used in the field. A study of this kind should reveal what measures of an administrative, educational, economic, financial and social nature are required to remedy what seems to be a very disturbing situation with regard to Sudan's ambitions for the development and technological progress of its agriculture.

APPENDIX 1

Supporting studies carried out by the research team:

- Abd El Cader: Head of the Planning Section at the Ministry of Education, co-ordinator of the research team appointed by the Ministry of Education: "Quantitative estimate of the supply and demand for trained agricultural staff".
- Ousmane Youssouf: Head of the Training Division at the Ministry of Education: "Historical trends in agricultural education in Sudan".
- Abd El Fadil: Labour Department, Ministry of Social Affairs: "The social, administrative, economic and cultural causes of the shortage of agricultural staff".
- Hussein Abd El Haffiz: Department of Technical Education, Ministry of Education: "Adapting the content of agricultural education to the requirements of the development plans".
- Mustafa Yussuf: Planning Section of Education, Ministry of National Planning: "Planning the supply of staff for agriculture: the short and long-term process".

APPENDIX 2
VISITS AND INTERVIEWS

Schools

- Talha agricultural school
- Um Dow Ban agricultural school
- Shambat Institute of Agriculture
- Kuku Institute of Veterinary Science
- Abu Haraz Institute of Agriculture
- Shambat Faculty of Agriculture (Khartoum University)
- Gezira Faculty of Agriculture.

Government organisations

- Ministry of Education: all the important sections and departments -
in particular the Planning Department.
- Ministry of Agriculture:
 - . training division
 - . plant protection division
 - . extension division
 - . mechanisation division
 - . provincial affairs (traditional agriculture)
- Gezira Board and Gezira Scheme - Guneid-Managil
- Mechanised Farming Corporation: Farm of Gedaref (state farm)
machine repair and service
workshop.
- Malakal: Junglei canal project.

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